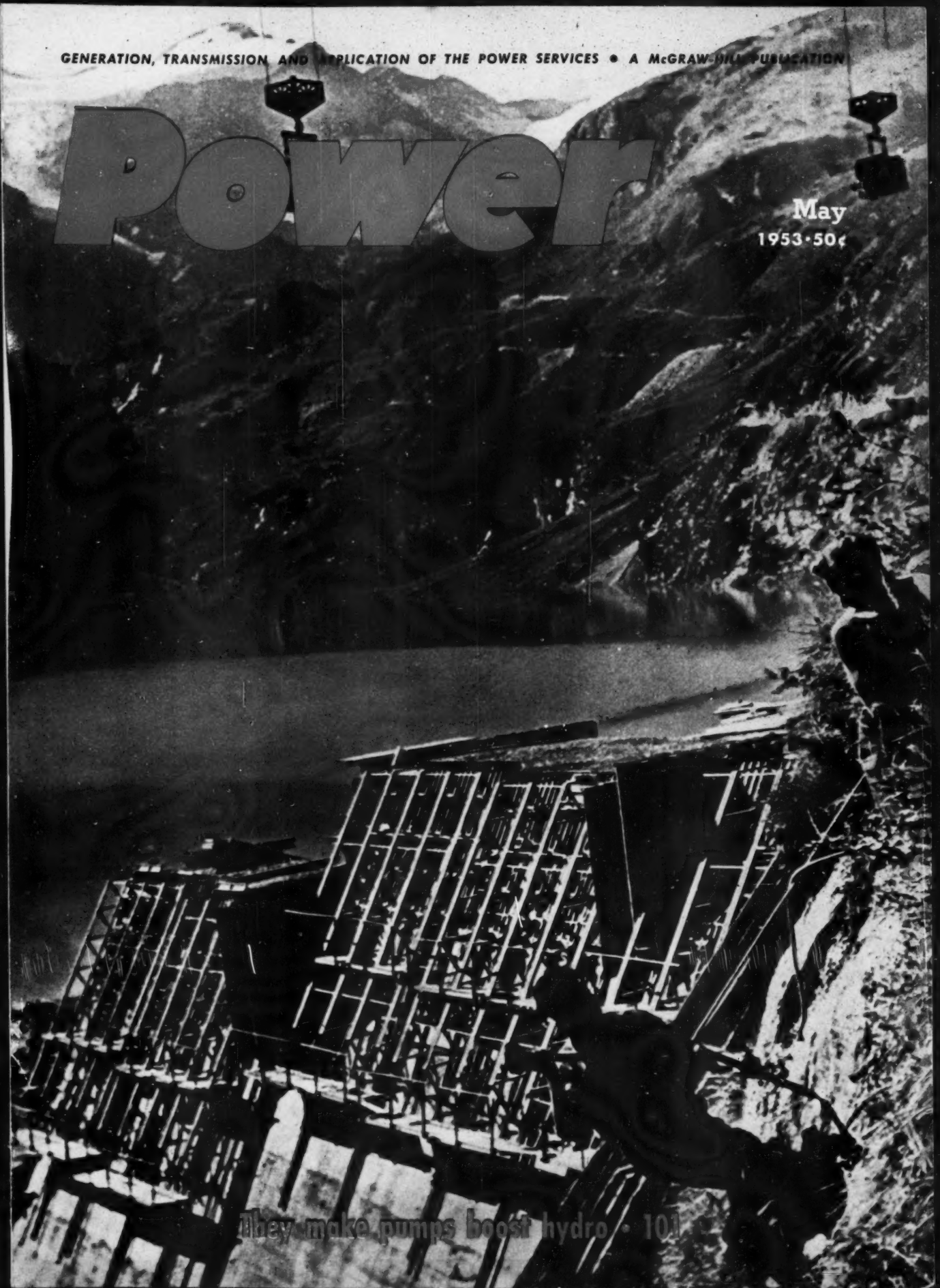
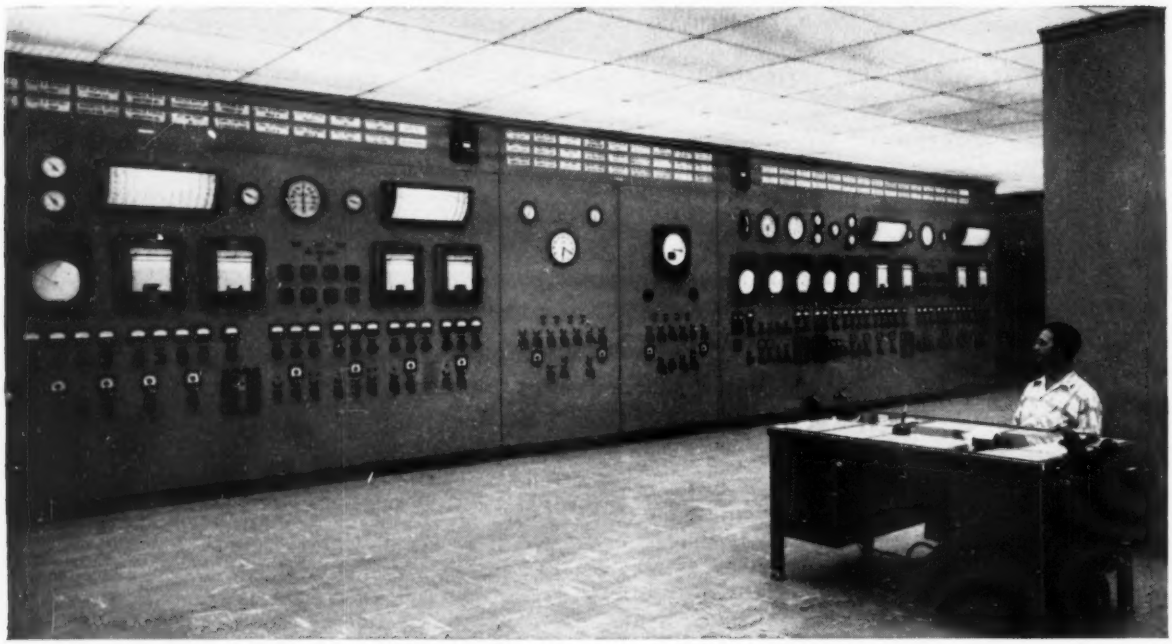
GENERATION, TRANSMISSION AND APPLICATION OF THE POWER SERVICES • A McGRAW-HILL PUBLICATION

Power

May
1953 • 50¢



They make pumps boost hydro • 101



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at L&N

Panels are custom-engineered by specialists who have built panels for many of the country's major utilities during the past fourteen years. L&N panel engineering is a *complete* service of the Leeds & Northrup Company, 4910 Stenton Ave., Philadelphia 44, Pa.

LEEDS NORTHRUP

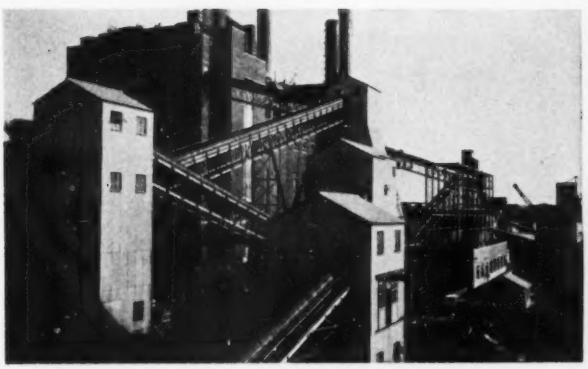
INSTRUMENTS AUTOMATIC CONTROLS • FURNACES

Jrl. Ad N-460(9)

From barge to bunker...

One of two Link-Belt Speeder Cranes unloads barges. The Link-Belt system then transfers coal to storage bunkers or to ground storage.

LINK-BELT cuts coal handling costs



Recent addition at this station included twelve 24-in. Link-Belt belt conveyors. En route to bunkers coal is crushed and weighed.

Two of six Link-Belt belt-propelled trippers empty coal into storage bunkers. Link-Belt Series 100 Idlers are used throughout.

Eastern power plant utilizes LINK-BELT's proved engineering and equipment for top efficiency

WHEN this power plant wanted to increase its coal handling capacity to 325 tph, they chose Link-Belt. With eight years' successful operation of an earlier Link-Belt system, they knew they could expect top efficiency.

Now, from the time two Link-Belt Speeder pedestal-mounted cranes unload river barges . . . until six belt-propelled trippers discharge into storage bunkers—handling is completely mechanical. By integrating the old and new systems, complete flexibility is achieved.

Whether your coal requirements are large or small, you, too, will find it pays to rely on Link-Belt. There's a 44-page book—No. 2410—that shows scores of typical modern power plant layouts. Ask the Link-Belt office near you for a copy.

LINK-BELT

COAL HANDLING EQUIPMENT

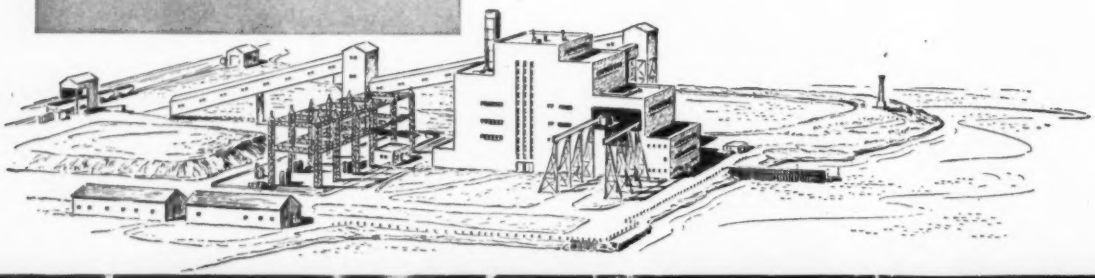
LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia).
Sales Offices in Principal Cities.

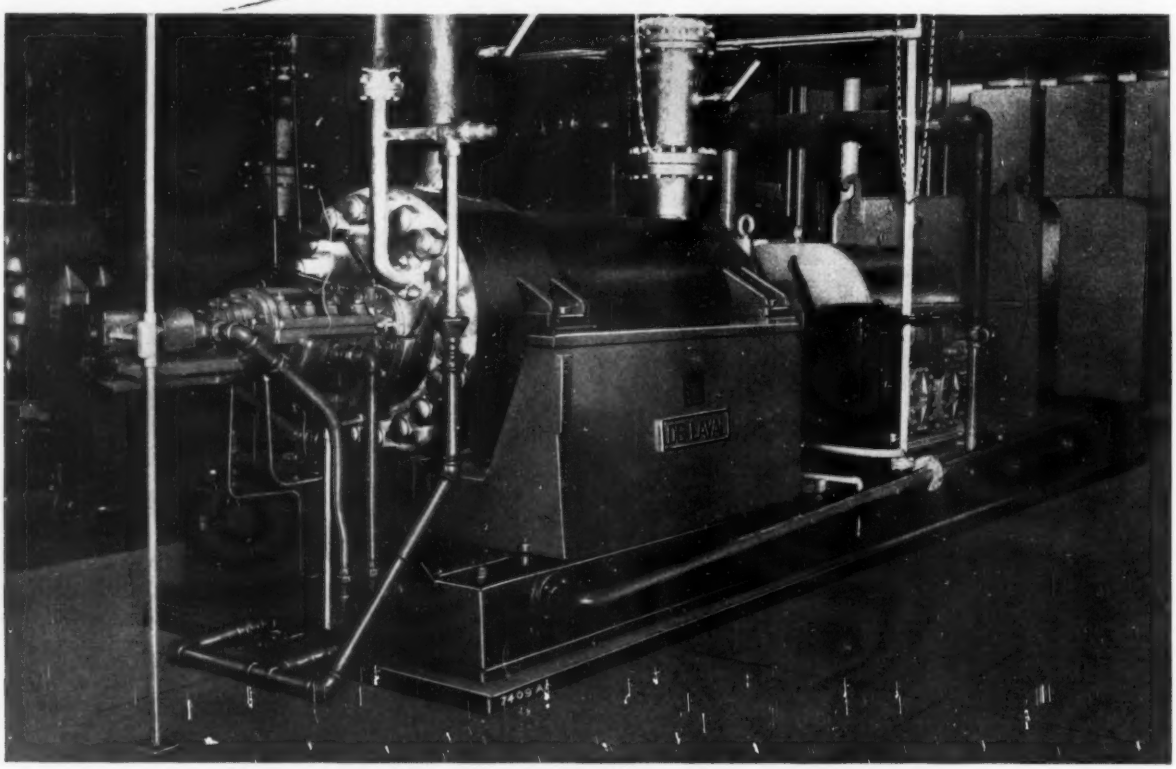
15,211

DE LAVAL

BARREL TYPE
BOILER FEED PUMPS

on the job at Danskammer Point





These two De Laval 11-stage barrel type boiler feed pumps are now helping to produce power for the Danskammer Point Steam Station of the Central Hudson Gas and Electric Corporation. Both pumps, one of which is used for standby service, are sized for full boiler load and will deliver 1,400 gpm of 326F water against 2,155 psig discharge pressure. Two more same size De Laval pumps have already been ordered for the second main unit of the Danskammer Station.

De Laval barrel type boiler feed pumps meet all the requirements of high pressure boiler feed service. They can be thrown on the line quickly without long preliminary warming up. They are not affected by sudden temperature changes. The distinctive De Laval design assures years of reliable service with minimum maintenance.

DE LAVAL *Boiler Feed Pumps*

DE LAVAL STEAM TURBINE COMPANY
815 Nottingham Way, Trenton 2, New Jersey

DL 179

Power

MAY 1953 • VOLUME 97 NUMBER 5

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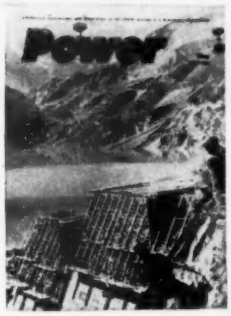


HYDRO PROJECTS often involve unusual construction problems, and this is true of Austria's big Glockner-Kaprun development pictured on our cover. But the real interest for power men lies elsewhere. Pumped storage is what makes this project tick. With it, and high heads, a little river does a terrific peak-load power job.

As you'll see from the story on pp 101-104, Glockner-Kaprun also abounds in impressive statistics. It's the world's largest pumped-storage project, and in using over 4100-ft head from reservoirs 6700 ft above sea level it will have two of the most powerful pelton turbines and highest powered pumps. Its 450,000-hp capacity will supply more than 800 million kwhr per yr, over 10% of Austria's total power use.

Next month...

■ Big June feature is a 20-p special report on compressing air. Starting with fundamentals of air, it covers all types of compressors and accessories. Then comes practical dope on controls, selecting units, planning an air system. Tips on operation wind up what promises to be an unusually helpful handbook.

■ We said we'd start the new series by Don Swift—on getting a new plant built and operating—in this issue. But we ran into some delays, so watch for the kickoff next month.

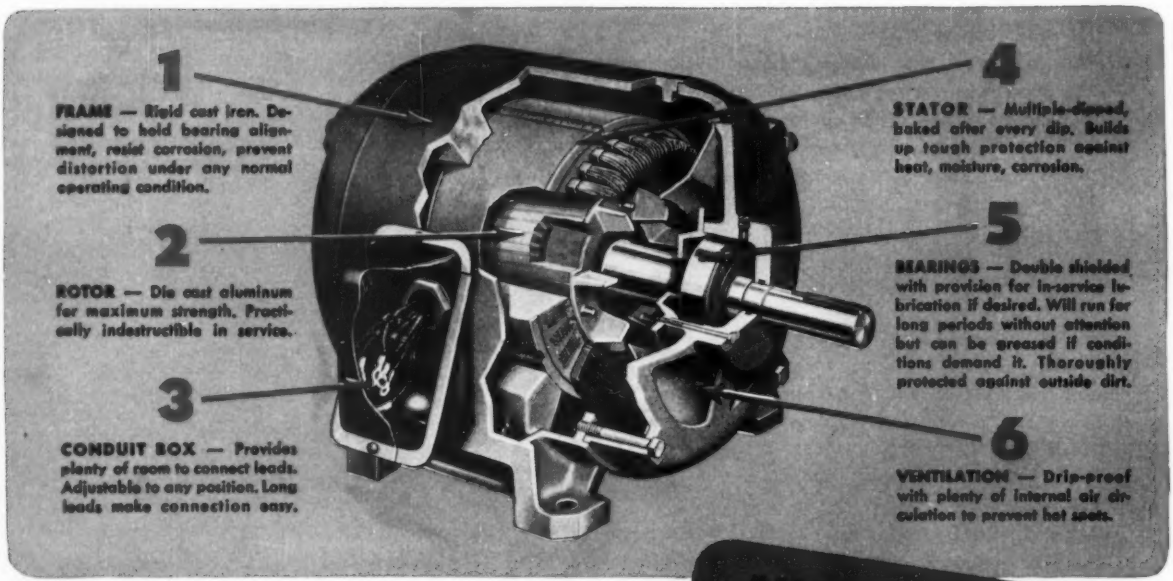
■ Does air conditioning pay? Read what the president of a machine-tool company has to say in a June article comparing gains in quantity and quality of production with costs of conditioning.

■ Many of us find keeping track of maintenance is harder than doing the job. To see what can be done to simplify and speed the paper work, look for a blow-by-blow story of how a big eastern industrial plant does it.

...and future months

■ Two important features will be combined, and a new one added in our Modern Plant Handbook issue, scheduled for Mid-Sept. Familiar features are the survey of new plants and additions, and the buyers' guide. New one is a "renovation roundup"—practical pointers on modernization.

Look for These 6 Signs of Good Motor Design


1
FRAME — Rigid cast iron. Designed to hold bearing alignment, resist corrosion, prevent distortion under any normal operating condition.
2
ROTOR — Die cast aluminum for maximum strength. Practically indestructible in service.
3
CONDUIT BOX — Provides plenty of room to connect leads. Adjustable to any position. Long leads make connection easy.
4
STATOR — Multiple-dipped, baked after every dip. Builds up tough protection against heat, moisture, corrosion.
5
BEARINGS — Double shielded with provision for in-service lubrication if desired. Will run for long periods without attention but can be greased if conditions demand it. Thoroughly protected against outside dirt.
6
VENTILATION — Drip-proof with plenty of internal air circulation to prevent hot spots.

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Certified Service — Nearly 100 Allis-Chalmers Certified Service Shops provide factory-approved parts and service on your Allis-Chalmers motors. Screened for modern equipment, adequate experience and business integrity, these independently owned service shops will provide you with prompt, economical repair and maintenance.

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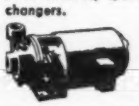
TEXROPE V-belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.



PUMPS — Integral types from ¾ in. to 72 in. discharge and up.

Power

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...lines and bylines

C F Neergaard and some of his hospital plans

MAKING HOSPITALS BETTER is the full-time activity of Charles F Neergaard and his associates, Drs Harvey Agnew and Allan Craig. They specialize in hospital consultation.

Neergaard graduated from Yale in 1897, spent his early years in the building industry. World War I saw him a major in the American Red Cross, inspecting their activities in 22 hospitals of the Atlantic Division. He organized and directed Red Cross in U.S. Debarkation Hospital No. 5, at Grand Central Palace, N. Y.

Since 1922, Neergaard has devoted his entire time to consultation, advising over 350 hospitals here and abroad. He's a life member of American Hospital Association, was chairman of its committee on hospital planning and equipment and a member of committees on standardization of equipment and air conditioning. He belongs to the International Hospital Association and is a charter member of the American Association of Hospital Consultants.

Author of over a hundred articles on hospital planning, equipment and economics (see pp 77-79), Neergaard has also lectured on these subjects at Yale, Princeton, Marquette and New York universities.

W L Byler

DIVERSITY marks Bill Byler's experience. A 1935 business-college graduate, his early work was in accounting and industrial sales. A wartime job with Peabody Engineering Corp took him over to the mechanical side and into engineering studies at New York University (BME, 1948).

With Mackenzie Engineering Co, Bill did field engineering and estimating on combustion equipment and flyash collectors. Next came work on mechanical power transmission and then his present post as manager of Imo pump sales for De Laval.

Bill is a member of ASME and of Pi Tau Sigma, honorary mechanical engineering fraternity. He likes to write (see p 120) but manages time for other arts—music and photography—and for that most frustrating of all sports activities—golf.

M E Gilwood

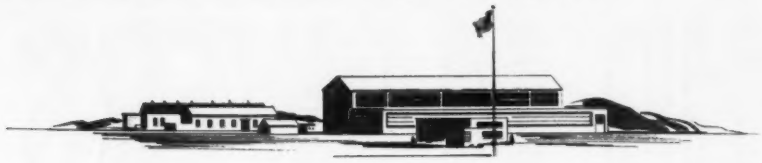
ION EXCHANGE, from the wartime seawater desalting kit to high-pressure boiler applications, has been Martin Gilwood's specialty since graduating from Rensselaer in 1936. Armed with a BS in chemical engineering, he entered Permutit's research department, of which he is now director.

With development experience ranging from the complex polymer chemistry of resin preparation to pioneering applications of ion exchange to therapy, Martin is well prepared to tackle the knotty question of mixed-bed vs 2-step demineralization, which he does on p 73. There are plenty of angles to this one, so if you disagree, let us know.

Martin's home life centers around two daughters, but includes time for carpentry, gardening and reading. He collects classical records but likes "pop" tunes, too. As for sports, he has just about given up handball, now dabbles in tennis, makes occasional tries at golf, and dreams of getting a sailboat again, when his daughters are old enough.

	EFFICIENCY	MAINTENANCE
CYCLONE STEAM SEPARATOR	• Simplifies attainment of higher pressures for greater cycle efficiency.	• Simple construction. • No pumps, motors to maintain. • Less chance of having burned-out tubes. • Less carry-over deposit on superheater tubes. • Cleaner turbines. • Fewer turbine outages.
DIVIDED FURNACE CONSTRUCTION		

From B&W Research & Engineering . . .



important answers to rising costs

By assuring adequate and positive circulation, B&W's Cyclone Steam Separator has made possible higher steam pressures, greater turbine efficiency, and has facilitated the use of Divided Furnace Construction to reduce material costs and keep boiler and building volume to a minimum. These engineering advances make possible cost and operating savings enjoyed exclusively by operators of B&W central station and industrial boilers. The chart below suggests many of these savings . . . all merit serious consideration in your evaluation.

We will be pleased to discuss these and other practical developments of B&W Research and Engineering as they relate to your power generation program and facilities. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

BABCOCK & WILCOX
BOILER DIVISION

G-598

AVAILABILITY	AUXILIARY POWER	INITIAL COST	ACCEPTANCE
• No unnecessary restrictions in water flow path. • Consistent high steam purity. • Positive circulation to all circuits. • Fewer tube burn-outs.	• No power required for circulation.	• No pumps, motors or connections.	The simple, highly efficient Cyclone Steam Separator has been proved in thousands of central station and industrial installations . . . has made possible B&W's singular success with high pressure boilers. In the range over 2000 psi, more than 14 B&W boilers are in operation . . . some with records extending over 14 years . . . and an additional 60 units are being built.
• Reduces slagging in furnace and convection surfaces.		• Greater cooling surface without increasing furnace volume reduces steel and other material costs by keeping boiler and building volume to a minimum. Lowers furnace construction costs. Saving in boiler cost.	Long term central station operation at boiler design pressures as high as 2650 psi, has proved the cost-saving advantages of B&W's Divided-Furnace construction in all types of large units. Many of the more than 95 B&W Divided-Furnace Boilers in operation have been in service for over 12 years, and more than 90 additional units are now on order.

DIAMOND BLOWERS

on Stations with HEAT RATES* LESS THAN 11,000 btu during 1951

Evidence continues to mount showing the dollars-and-cents value of Diamond Blowers. For example, the heat rate information shown at the right. It is taken from the annual report issued by the Federal Power Commission. As may be seen, an overwhelming majority of the stations with the best records of "Average Btu per Kilowatt-hour Net Generation" in 1951 are equipped with Diamond Blowers.

Low heat rates are impossible unless boilers are kept clean. And, correct cleaning not only improves heat rates, but also the availability of boilers.

Diamond, with 50 years experience, has the equipment and the knowledge of blower application to assure correct boiler cleaning . . . and at lowest overall cost.

Check this list for yourself . . . it is another reason for the wide preference for Diamond Blowers.

*From FPC report entitled "Steam Electric Plant Construction Cost and Annual Production Expenses for 1951."

DIAMOND POWER SPECIALTY CORP.

LANCASTER, OHIO

DIAMOND SPECIALTY, LIMITED
WINDSOR, ONTARIO

50th ANNIVERSARY
1903-1953

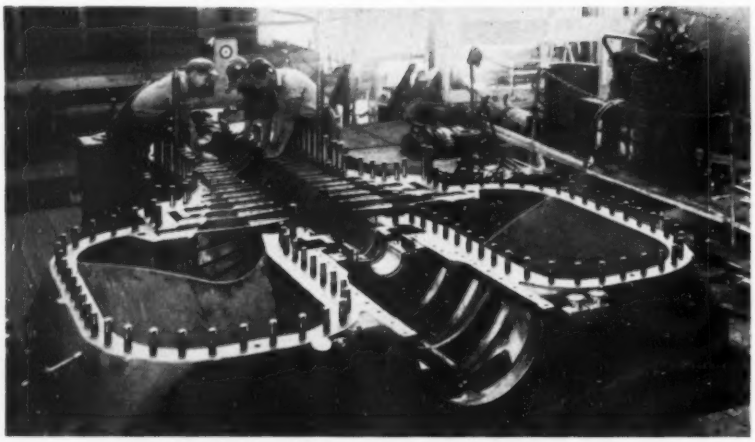
LOW HEAT RATES (AND HIGH AVAILABILITY) DEMAND CLEAN BOILERS AS WELL AS ADVANCED STATION DESIGN

PREDOMINATE

Proof of BETTER Boiler Cleaning

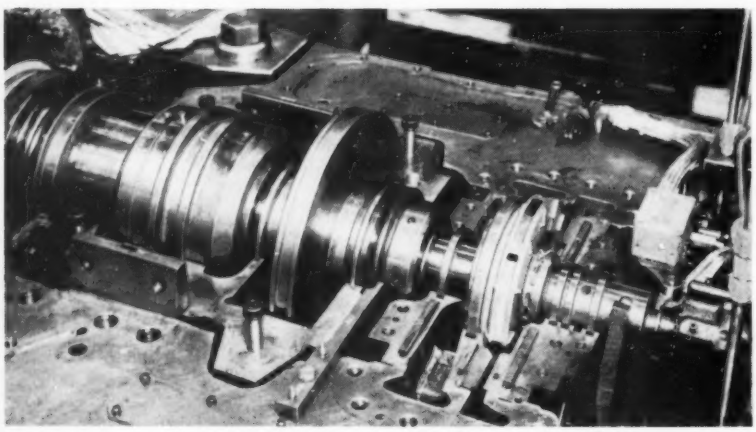
	STATION	UTILITY COMPANY	HEAT RATE BTU/KWH
◆	Tanners Creek	Indiana & Michigan Electric Company	9,354
◆	Schiller	Public Service Co. of New Hampshire	9,379
◆	Philip Sporn	Appalachian Electric Power Company	9,418
	Dunkirk	Niagara Mohawk Power Company	9,540
	Titus	Metropolitan Edison Company	9,886
◆	W. S. Lee	Duke Power Company	9,954
◆	Cecil Lynch	Arkansas Power & Light Company	10,170
◆	Pt. Washington	Wisconsin Electric Power Co.	10,329
◆	O. H. Hutchings	Dayton Power & Light Company	10,372
	Russell #7	Rochester Gas & Electric Company	10,515
◆	Goldsboro	Carolina Power & Light Company	10,518
◆	Ridgeland	Commonwealth Edison Company	10,560
◆	Dan River	Duke Power Company	10,642
◆	Sewaren	Public Service Elec. & Gas Company	10,690
◆	Oswego	Niagara Mohawk Power Corp.	10,805
◆	Edge Moor	Delaware Power & Light Company	10,810
◆	Potomac River	Potomac Electric Power Company	10,918
◆	Lumberton	Carolina Power & Light Company	10,981
◆	Yates	Georgia Power Company	10,986

◆ *Stations having Diamond Blowers*

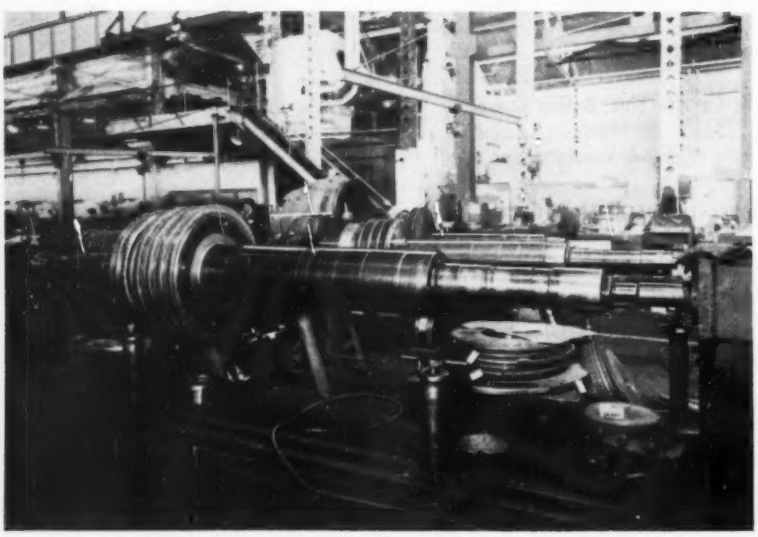


In a turbine alignment is everything. At left the initial factory alignment of bearings, shaft seals, and diaphragms is being checked and recorded so that it can be reproduced in the field, and design clearances established on assembly are maintained in operation.

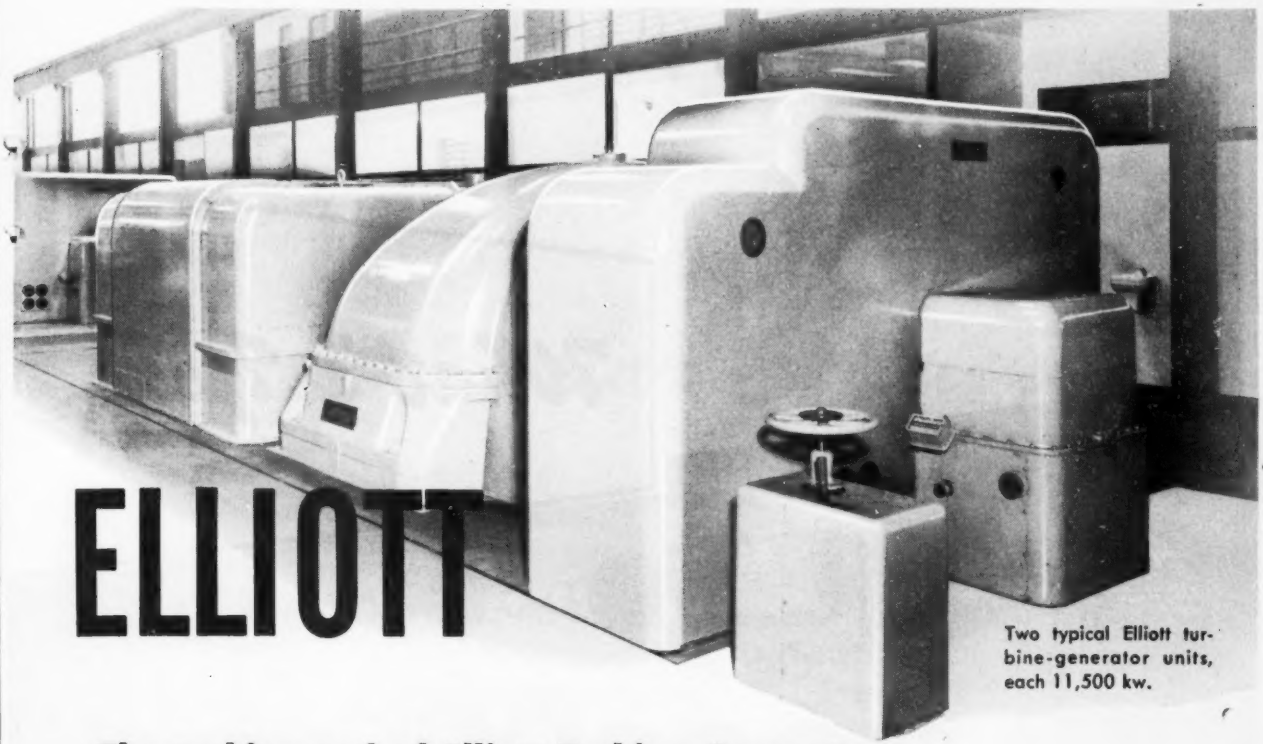
They build them well at



The steam end bearing case is arranged as a sliding pedestal to take up axial expansion. It carries the No. 1 bearing, thrust bearing, shaft-mounted main oil pump, overspeed trip pin, and speed governor. The centrifugal oil pump at 3600 rpm provides the reserve needed by the hydraulic control system, including sudden demands for large quantities of oil to move the valve servo motor on sudden load changes.



In turbine rotors initial temperature shocks in the first stages cause faster expansion in the disc than in the shaft. This would tend to relieve a shrink fit, thus upstream wheels for Elliott large, high-temperature turbines are forged integral with the shaft. In later stages temperature changes in disc and shaft are more nearly uniform, and the problem is replaced by that of higher stress due to the larger diameters and heavier blading. This increased physical stress is met by using special alloy discs shrunk on the shaft. Such individual discs have higher physicals than can be obtained in the large shaft forging and are therefore best suited to the higher blade loads, and with the low temperatures in these down-stream stages temperature changes do not affect the shrink fit.

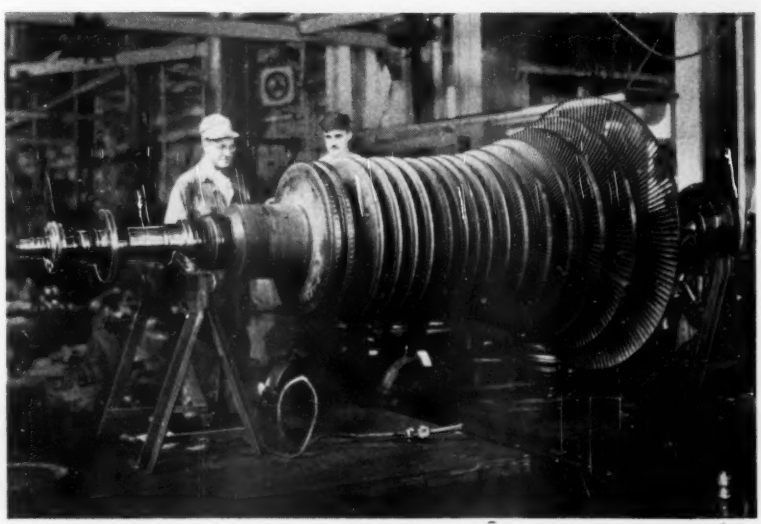


ELLIOTT

Two typical Elliott turbine-generator units, each 11,500 kw.

The turbine end of Elliott Turbine-Generators exemplifies the extreme care and high degree of engineering skill that has become known as characteristically Elliott. Look over the pictures on these two pages—they speak for themselves. For full data on completely Elliott-built turbine-generators, contact your local Elliott representative or write Elliott Company, Jeannette, Pa.

ELLIOTT Company
Steam Turbine Dept.



With the many physical and chemical checks on material going into the finished rotor, is the final inspection after the shake-down run at speed and overspeed on the test block. While material control during each step in manufacture minimizes the hazard of test operational failure, the final proof of the rotor lies in black light inspection for cracks in shrouding and other parts.

H3-3

What's Your

This Bailey Boiler Control Panel at Lacombe Station of Public Service Company of Colorado saves fuel and insures safe operation of a 350,000 lb per hr 850 psi, 900 F boiler fired by pulverized Colorado Lignite Coal and/or natural gas.

Controls for Steam Plants

COMBUSTION • PRESSURE
FEED WATER • LIQUID LEVEL
TEMPERATURE • FEED PUMPS

Control-Dollar Efficiency ?

Control-dollars frequently bring annual investment returns of 100% or more. When you buy adequate, well-applied steam plant controls, you increase your dollars' ability to work usefully for you.

That's where Bailey can help: Bailey Controls can give you a better control-dollar efficiency. Here's why:

1. Complete Range of Equipment — fully co-ordinated. You need never worry that a Bailey Engineer's recommendation is slanted in favor of a particular type of equipment, just because he has a limited line to sell — or that Bailey will pass the buck for efficient control; we offer *complete* boiler control systems.

2. Engineering Service — backed by experience. No other manufacturer of instruments and controls can offer as broad an experience, based on successful installations involving all types of combustion, flow measurement, and automatic control.

3. Direct Sales-Service — conveniently located near you. Bailey Meter Company's sales-service engineers are located in more industrial centers than those of any other manufacturer of boiler control systems; you get prompt, experienced service with a minimum of travel time and expense.

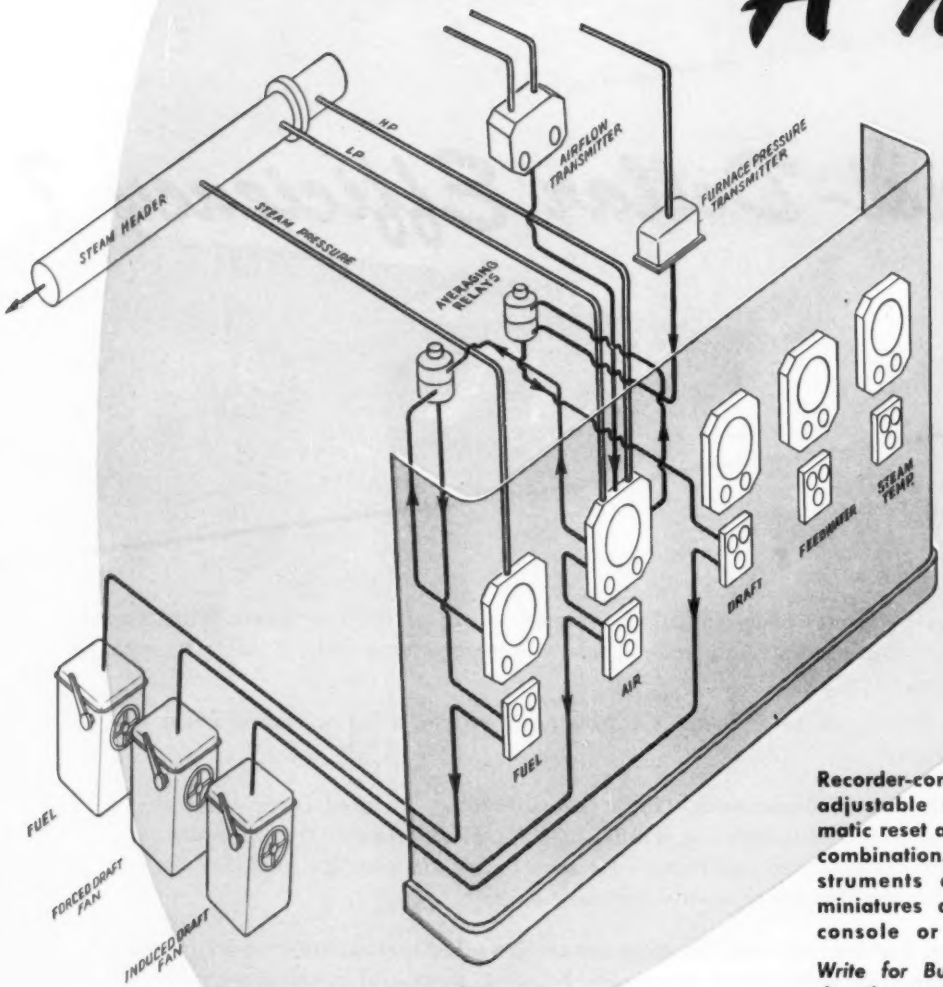
For better control-dollar efficiency—for more power per fuel dollar, less outage, and safer working conditions, you owe it to yourself to investigate Bailey Controls. Ask a Bailey Engineer to arrange a visit to a nearby Bailey installation. We're proud to stand on our record: "More power to you!"

A-112-2

BAILEY METER COMPANY

1036 IVANHOE ROAD • CLEVELAND 10, OHIO
BAILEY METER COMPANY LIMITED • MONTREAL, CANADA

A new



Recorder-controllers may have adjustable sensitivity, automatic reset and pre-act in any combination. Standard size instruments are shown, but miniatures are available for console or graphic panels.

Write for Bulletin 1007 which describes complete Copes-Vulcan Boiler Control.

WHAT'S IN A NAME?

COPES has for half a century specialized in the control of boiler feed water flow and pressure, boiler water level—and, more recently, boiler steam temperature.

VULCAN has since 1903 brought soot blowing from an act of drudgery to the ease and convenience of pushing a button at a centrally located control panel.

Taylor has for over 100 years led in instruments for measuring and controlling temperature, pressure, flow and liquid level in the process and power fields.

formula...

C·V+T=BBC

COPES·VULCAN+*Taylor*=BETTER BOILER CONTROL

This new formula gives you a fresh approach to boiler control.

Copes contributes experience with flow, level, pressure and boiler steam temperature. *Vulcan* provides an intimate knowledge of high-pressure, high-temperature steam generators. *Taylor* adds instrumentation of unequalled responsiveness and accuracy.

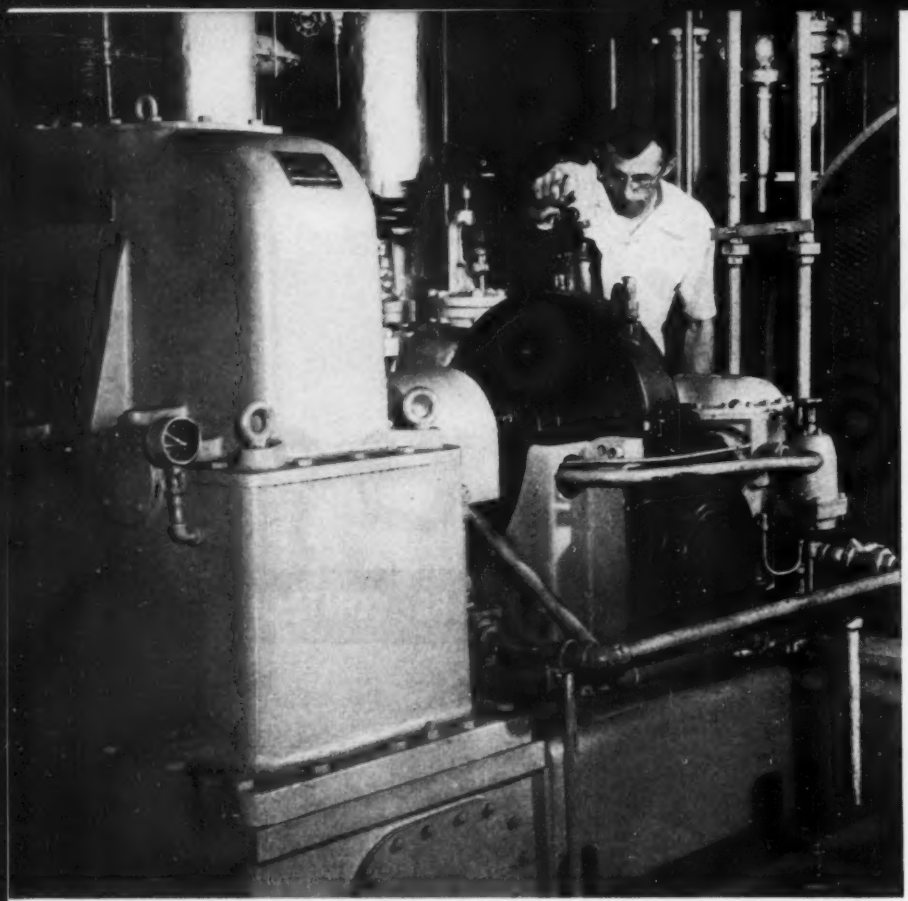
The result is *Better Boiler Control* —combining combustion, feed water, steam temperature and boiler cleaning in a *system* especially designed for your needs.

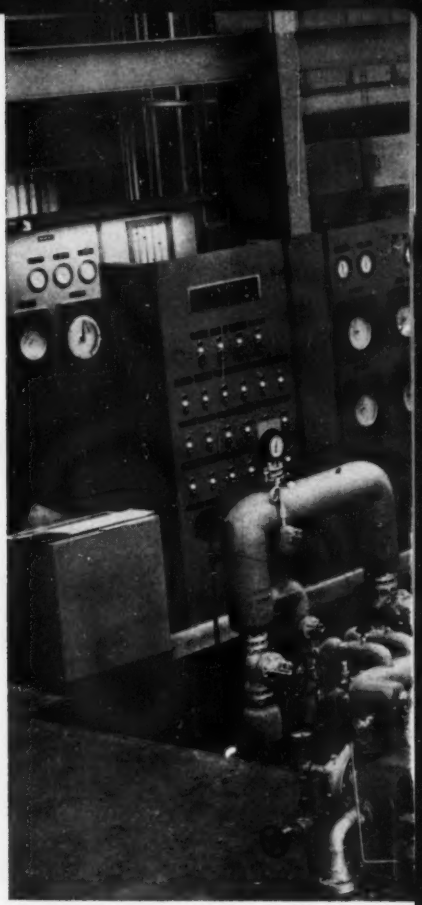
And Copes-Vulcan assumes full responsibility — from analysis of your conditions through on-the-job service for the life of the installation.

COPES-VULCAN DIVISION
CONTINENTAL FOUNDRY & MACHINE COMPANY
ERIE, PENNSYLVANIA

COPES VULCAN BOILER CONTROL

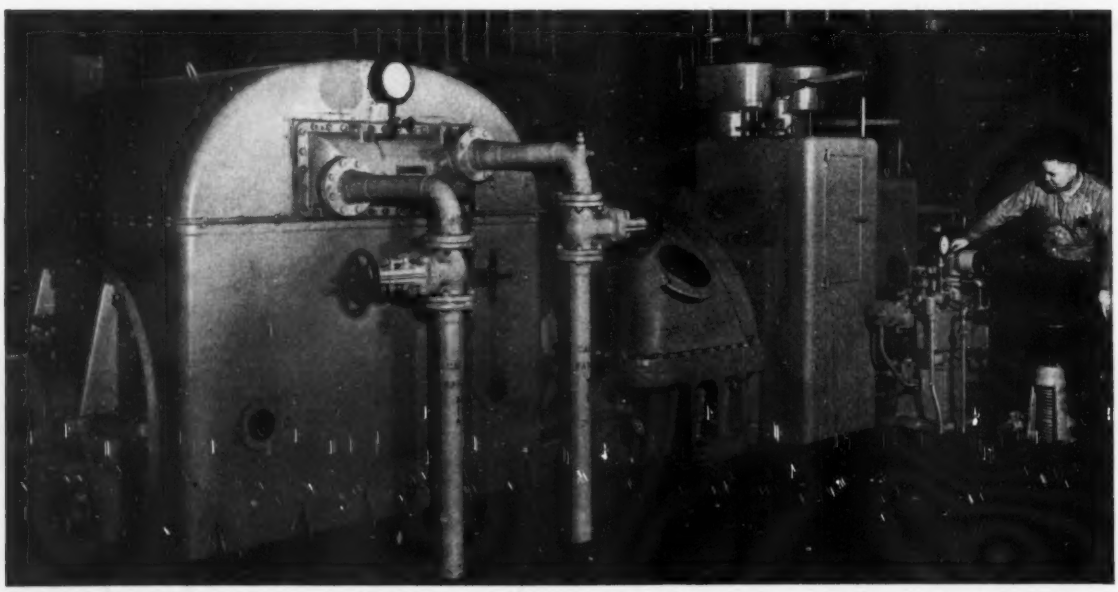
WITH INSTRUMENTATION
BY *Taylor*



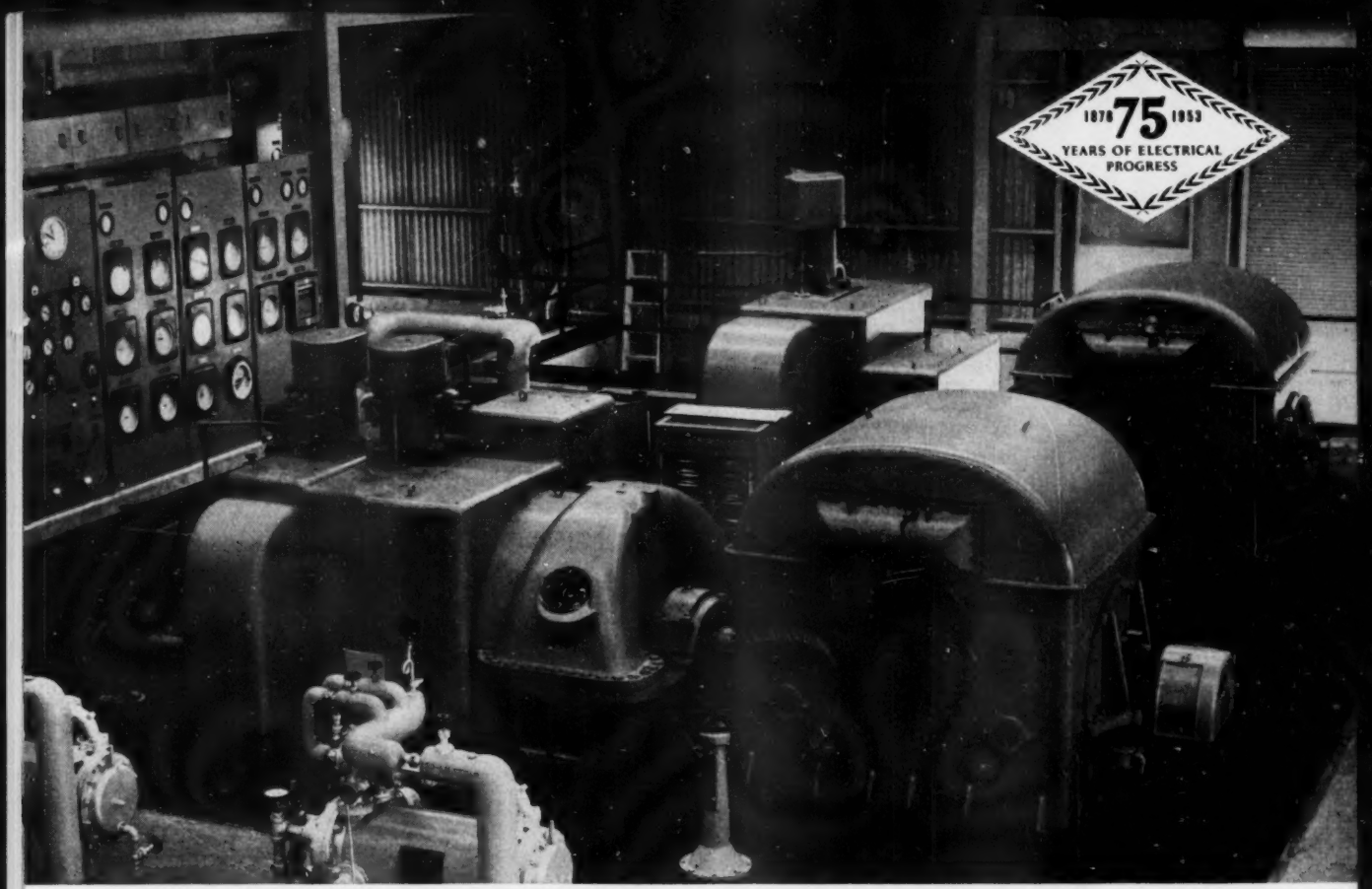


G-E TYPE DP MECHANICAL-DRIVE TURBINE, rated 135 hp, drives standby air compressors. J. A. Chamberlain, Supervisor of Utilities at Barber Refinery, checks turbine.

G-E Turbines Maintain Plant Steam



EASY STARTING of the General Electric 2000 KW double extraction turbine-generator at California's Refinery is demonstrated by W. E. Riley, Station Operator. Handwheel initiates small pilot valve, requires almost no muscle effort to operate.



DOUBLE-EXTRACTION CONDENSING TURBINE-GENERATOR in foreground supplies process steam at 150 psig and 15 psig for refinery operations at "California's" Barber, New Jersey plant. Other turbine is straight condensing.

Balance at "Calso's" Barber, N.J. Refinery

2000 KW Turbine-generators Reduce Boiler Steam to Process Pressures; Mechanical-drive Turbine with High-speed Precision Gear Drives Utility Air Compressor.

To make fullest use of available high-pressure steam, to obtain economical by-product power, and to automatically maintain plant steam balance over a wide range of steam flows, the California Refining Division of The California Oil Company selected two General Electric turbine-generators for its Number Two plant at the Barber, N. J. Refinery.

Extraction steam from one turbine-generator, a 2000 KW unit, is delivered at 150 psig and 15 psig for various process uses. Turbine governing accuracy is such that even when extraction steam or electrical load requirements vary, extraction pressures are held constant. A second 2000 KW unit exhausts to a condenser.

The "California" Refinery also installed a General Electric Type DP mechanical-drive turbine with a G-E high-speed precision gear to drive one of the compressors which furnishes utility air for use throughout the refinery. In an emergency, this turbine-driven compressor could meet complete compressed air demands.

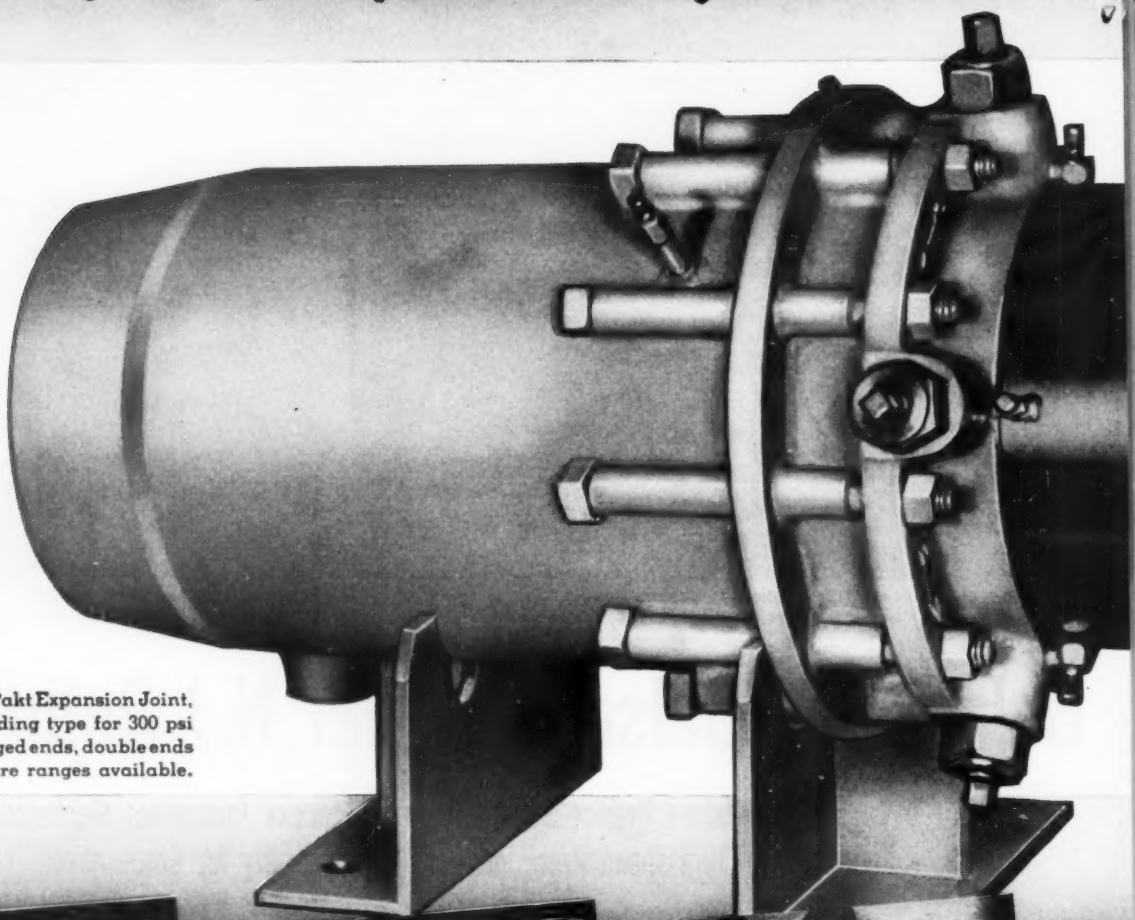
If your plant uses process steam, why not take advantage of G.E.'s experienced turbine engineering resources. G-E engineers will study and recommend ways for you to best utilize steam supply. Get more for your turbine dollar with G-E turbine-generators. General Electric, Schenectady 5, N. Y.

256-5

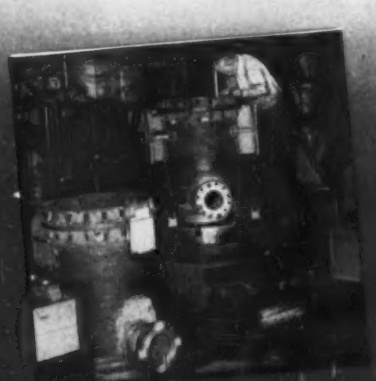
You can put your confidence in—

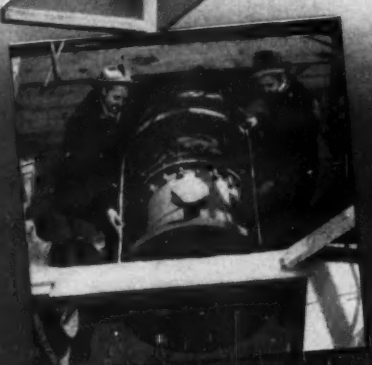
GENERAL ELECTRIC

PHILADELPHIA ELECTRIC
GUN-PAKT EXPANSION JOINTS for



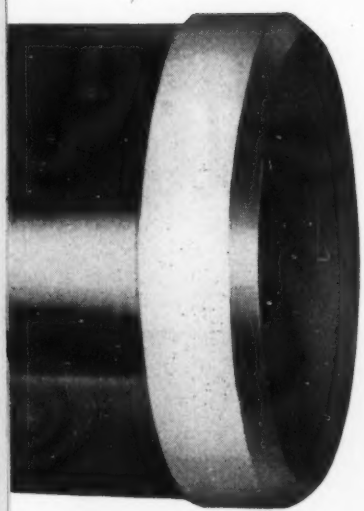
Yarway Gun-Pakt Expansion Joint, single end welding type for 300 psi pressure. Flanged ends, double ends and all pressure ranges available.





YARWAY

relies on 24" UNDERGROUND STEAM LINE

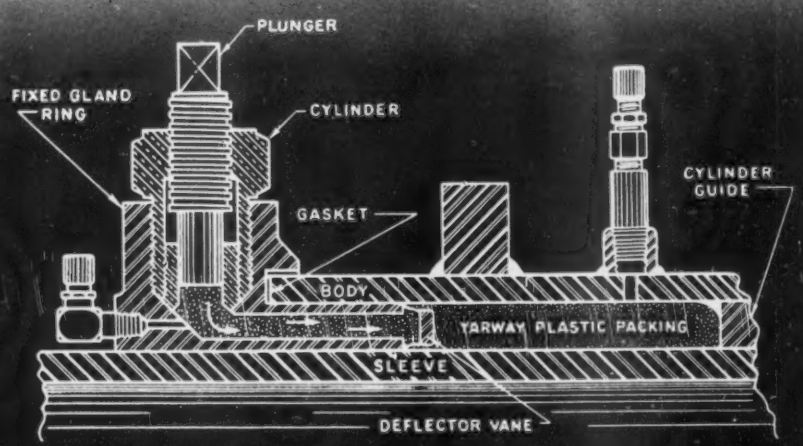


Philadelphia Electric Co. is one of many utilities, institutions and industrial plants who rely on Yarway Gun-Pakt Expansion Joints for steam distribution lines. As an example, twenty-four large 24" Gun-Pakt Joints are helping maintain PE's reputation for reliability, on their new 24" steam distribution line. Gun-Pakt Joints frequently are selected because of the following features.

- **HIGH FACTOR OF SAFETY.** Gun-Pakt Joints are rugged joints—strong and dependable.
- **LOW MAINTENANCE.** No need for shutdowns, because Gun-Pakt Joints are *serviced under full steam pressure.*
- **FEWER JOINTS NEEDED.** Each sliding sleeve may have a 4", 8", or 12" traverse—maximum expansion 24" for a double-end joint. Fewer needed in given length of line.

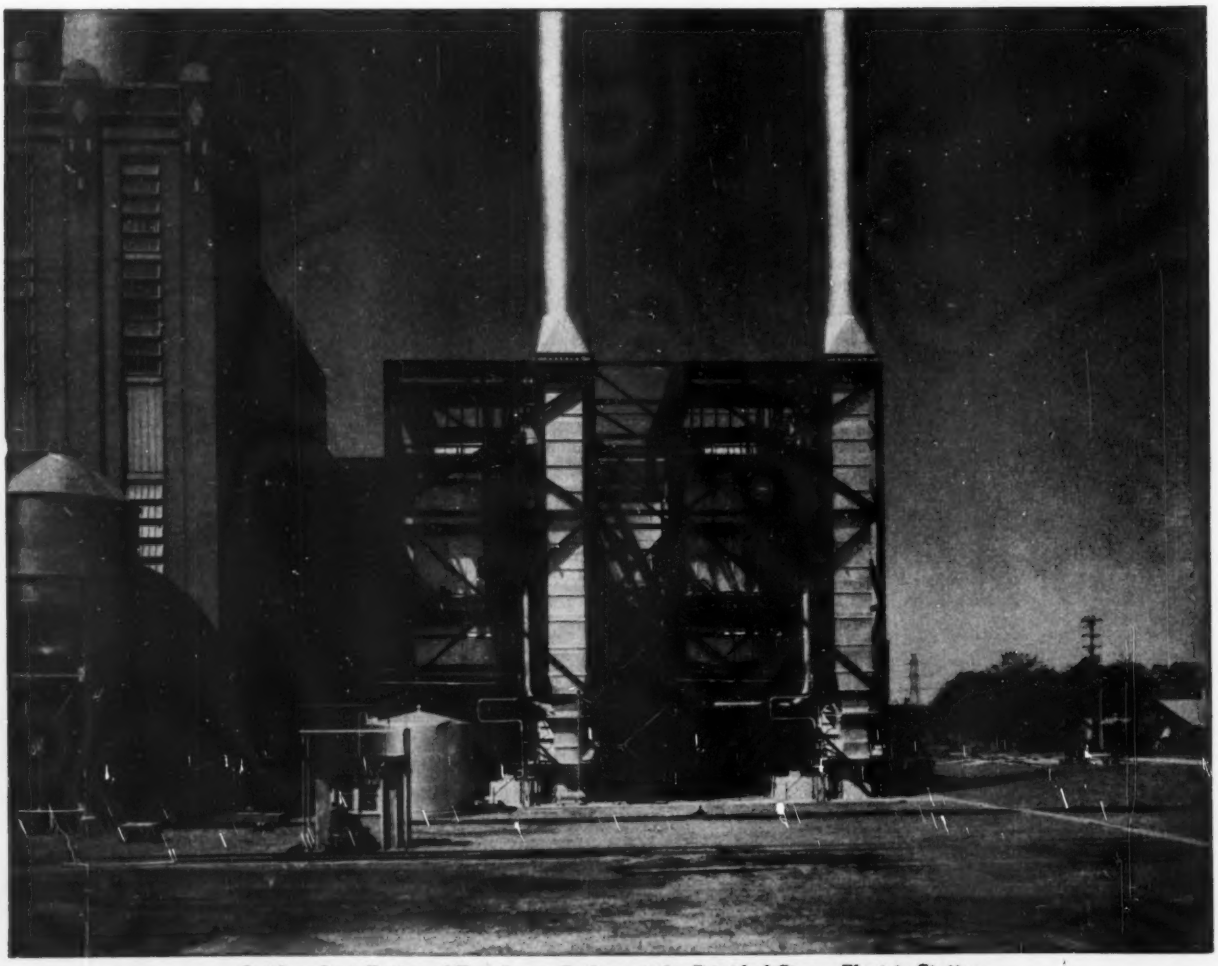
For the full story on these and other Gun-Pakt Expansion Joint features (like service outlets right on the joint) write for Yarway Catalog EJ-1912.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.
Branch Offices in Principal Cities



GUN-PAKT EXPANSION JOINT

Two Outdoor Boilers Under Automatic



Outdoor Installation of Two Large Boilers at the Trinidad Steam Electric Station.

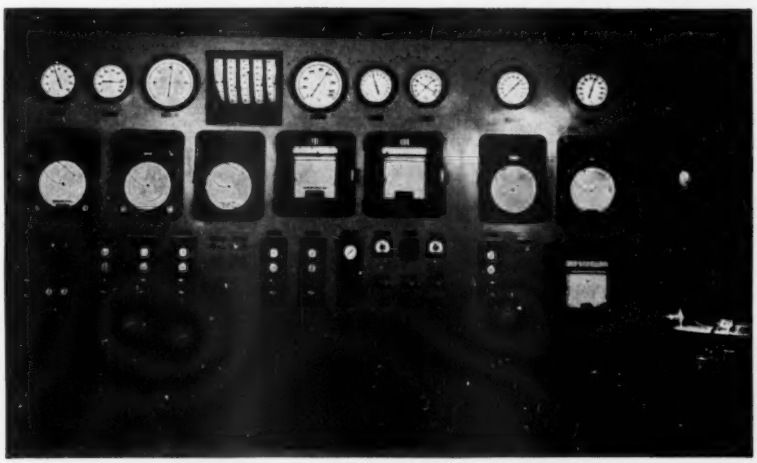
Aerial View of Trinidad Steam Electric Station. (Note the Two Outdoor Boilers Installed Behind the Main Building).

Control

at TRINIDAD STEAM ELECTRIC STATION • Texas Power & Light Company

● A most important part of the Texas Power and Light Company expansion program at their Trinidad Steam Electric Station, is this outdoor installation of two new gas fired, 350,000 lb. per hr. boilers. These boilers, operating at 920 psig., provide 70,000 KW additional capacity to meet the increasing power demand on the Trinidad Station. To achieve maximum efficiency and performance, the boilers were put under completely automatic control.

The AUTOMATIC COMBUSTION CONTROL system and the PRESSURE REDUCING AND DESUPERHEATING STATION were supplied by REPUBLIC FLOW METERS CO.



One Section of the Boiler Control Panels.

A Potent Tool for Cutting Costs

A properly engineered automatic control system is an effective way to cut power costs. Best of all, what automatic control is doing for the large plants such as the Trinidad Steam Electric Station it is also doing for their smaller brothers. But the full benefits can only be realized if the plant designer selects with great care the best control equipment for his job. The control must be carefully matched to the boiler and auxiliary equipment characteristics; it must maintain maximum combustion efficiency under all load conditions.

REPUBLIC CONTROLS are available for all types of load fluctuations, fuel firing, single or multiple fuels, and all types of boilers and auxiliary equipment. Backed by thirty-six years of specialized experience in combustion control, REPUBLIC'S power engineers have developed control systems to answer every type of steam generating problem.

Ruggedly built to outlast the boilers that they serve, REPUBLIC AUTOMATIC CONTROL gives you the best, most economical system engineered to suit your needs.

For more information on REPUBLIC AUTOMATIC CONTROL write for Data Book No. S-21 or contact our field engineer nearest you.

REPUBLIC FLOW METERS CO. ● 2240 DIVERSEY PARKWAY • CHICAGO 47, ILLINOIS

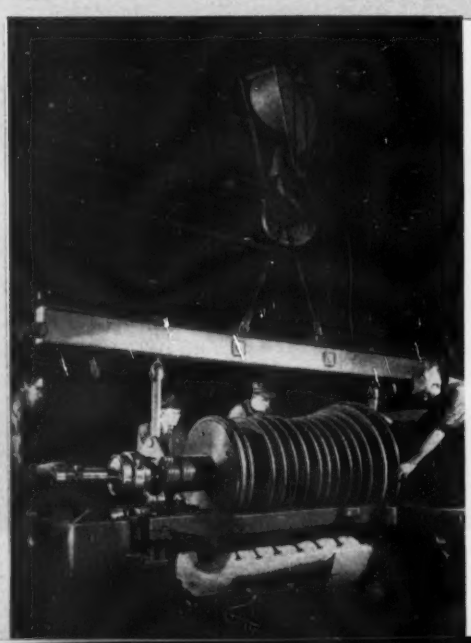
From Shop

HERE'S HOW Allis-Chalmers Builds the Generator Unit that's Easy to Install, Low in Foundation Cost

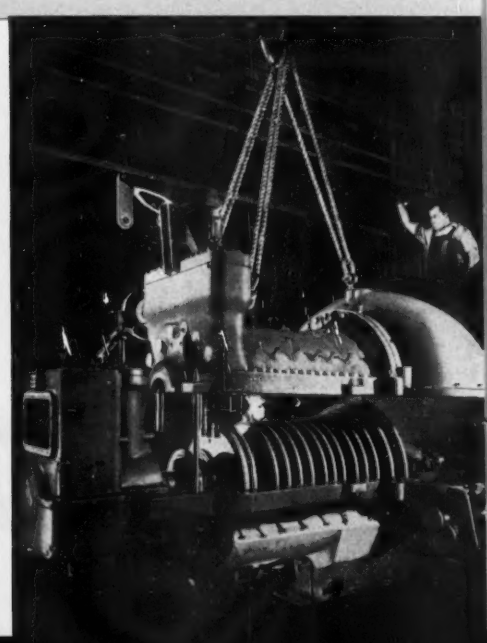
MODERN Allis-Chalmers WA-Series steam turbine generating units are factory tested and shipped with rotors locked in place to save you installation time. Oil piping and generator air coolers are both above the floor line to reduce your foundation costs.

WA-Series units are built in ratings from 2000 to 7500 kw for either condensing or non-condensing operation. For your copy of Bulletin 03B7654, call your nearest A-C office or write to Allis-Chalmers, Milwaukee 1, Wisconsin. A-3910

1 Precision balanced turbine rotor assembly being lowered into casing. All wheels have durable chrome alloy steel buckets.



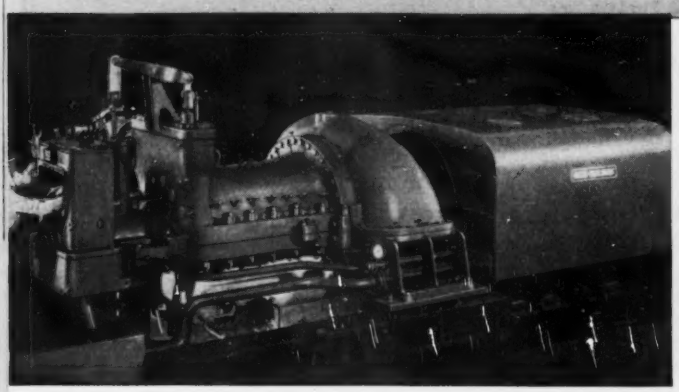
2 Upper half casing of this compact impulse steam turbine is next added in the process of assembling the WA-Series unit.

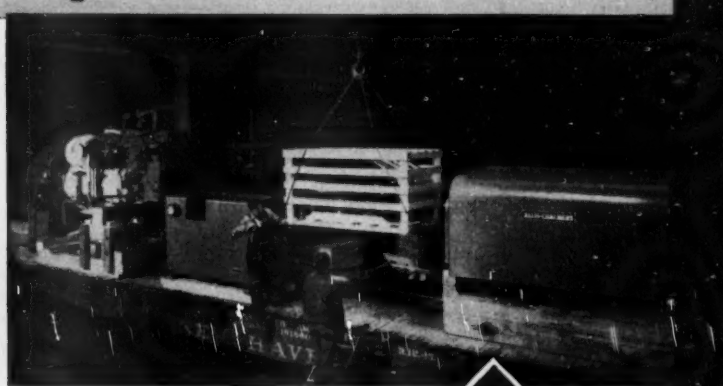


to Shipment!

3 Assembled 3-bearing unit — complete with housing type air cooled generator — ready for factory testing. Both oil piping and generator air coolers are above the floor line.

4 Entire WA-Series 3000-kw unit—pre-tested and insulated—being loaded on **one** flatcar for unit shipment. Both turbine and generator are shipped with their rotors securely locked in place.





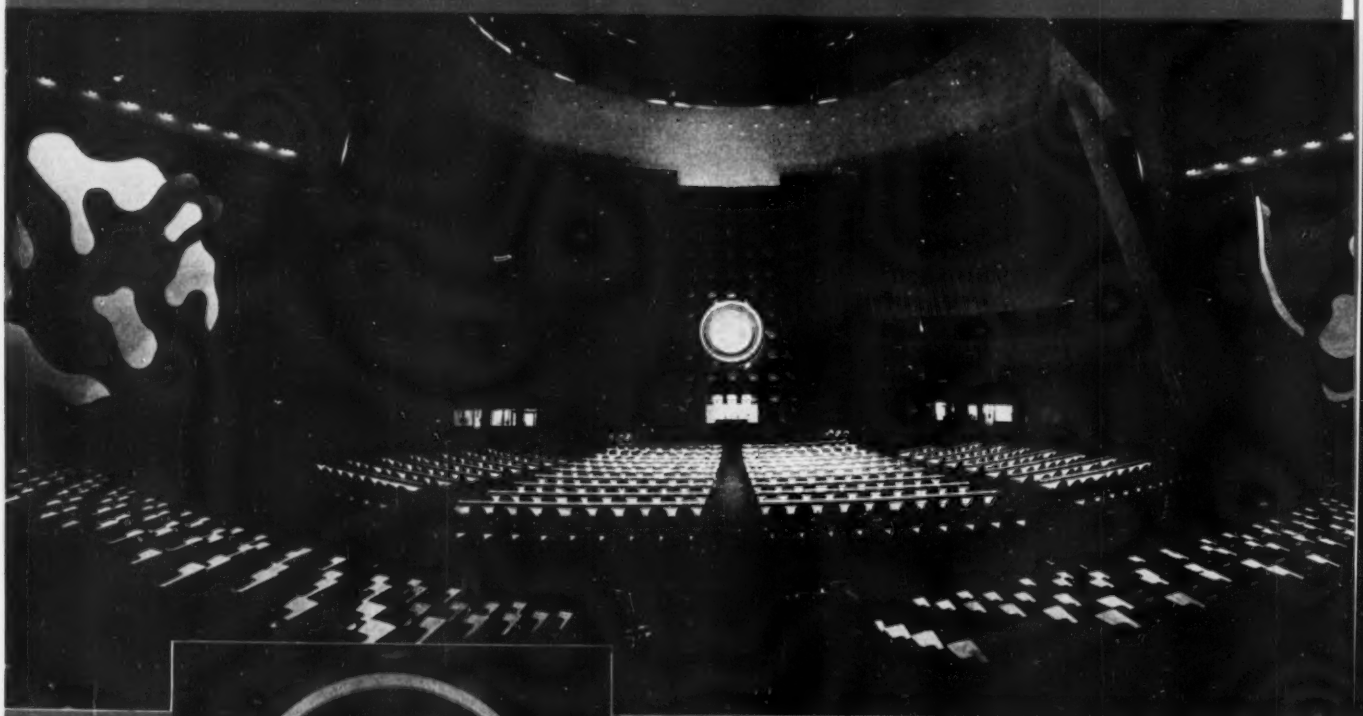
ALLIS-CHALMERS

World's Widest Range of Power Plant Equipment

A-C ALLIS-CHALMERS

UNITED NATIONS

UNATIONS PHOTOS



WORLD FAMOUS UN GENERAL ASSEMBLY HALL
Air Conditioned comfort is assured by POWERS CONTROL
Seating Capacity: 2000 Delegates, Visitors, Press, Radio, TV and Translators

Architects
WALLACE K. HARRISON, Director of the Headquarters Planning Office
MAX ABRAMOVITZ, Deputy Director
Consulting Engineers: SYSKA and HENNESSY, INC.
Contractor: KERBY SAUNDERS, INC.

Great Variety of Spaces Controlled by POWERS

In addition to the main hall and council chambers Powers control is used for the many tiers of glass booths occupied by the press, radio, TV and translators; also lounges, restaurants, bars, library, radio studios and garage. There is also considerable control for wall and panel heating and snow melting.

POWERS CONTROL — TEMPERATURE AND HUMIDITY

THE POWERS REGULATOR CO.

Skokie, Ill. Offices in Over 50 Cities. See your phone book

Since 1891

(b61)

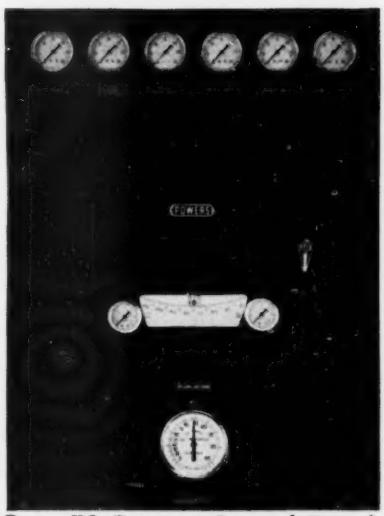
GENERAL ASSEMBLY AND CONFERENCE BUILDINGS ARE REGULATED BY POWERS

Pneumatic Systems of
AIR CONDITIONING CONTROL

IN this famous international forum the engineers have succeeded in supplying optimum atmospheric environment for peaceful discussions which may help bring about a better world.

Many meeting and conference rooms and other spaces are individually controlled by Powers pneumatic thermostats. Dry bulb temperatures are set at the control panel with a Powers Series 100 Indicating Controller. Outside air is used for cooling during the intermediate season. Relative humidity is controlled during all seasons of the year. The seasonal changeover to summer, intermediate or winter is made with switches in the central control room.

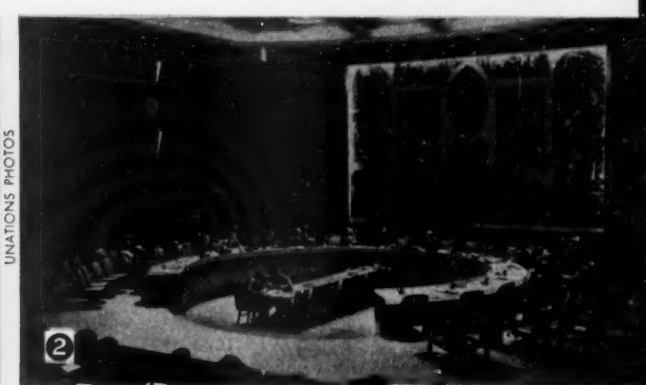
Experience gained by Powers here and in many other important large and small buildings may be helpful to you. Next time a temperature or humidity control problem arises, contact POWERS nearest office. There's no obligation.

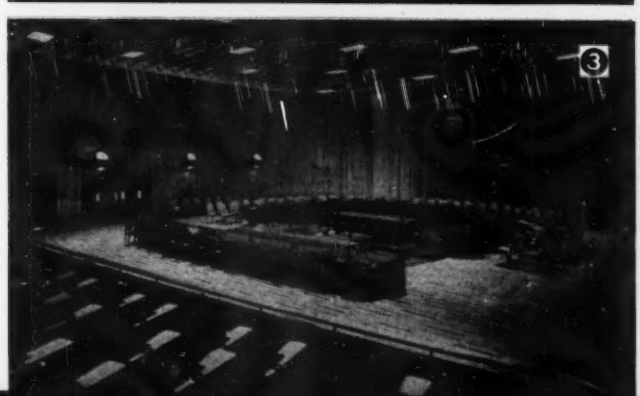


Over 70 Powers Control Panels for as many complete air conditioning systems are used at UN. Gauges on each panel indicate the position of controls.

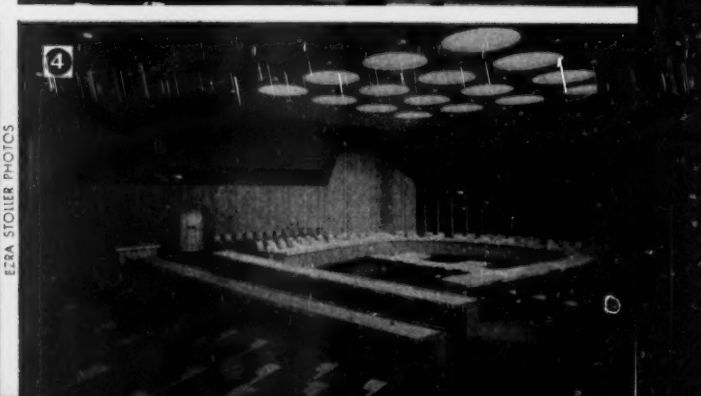
PHOTOS BELOW: (1) Translators in Air Conditioned Glass Booths (2) Security Council Chamber (3) Trusteeship Council Chamber (4) Economic and Social Council Chamber.

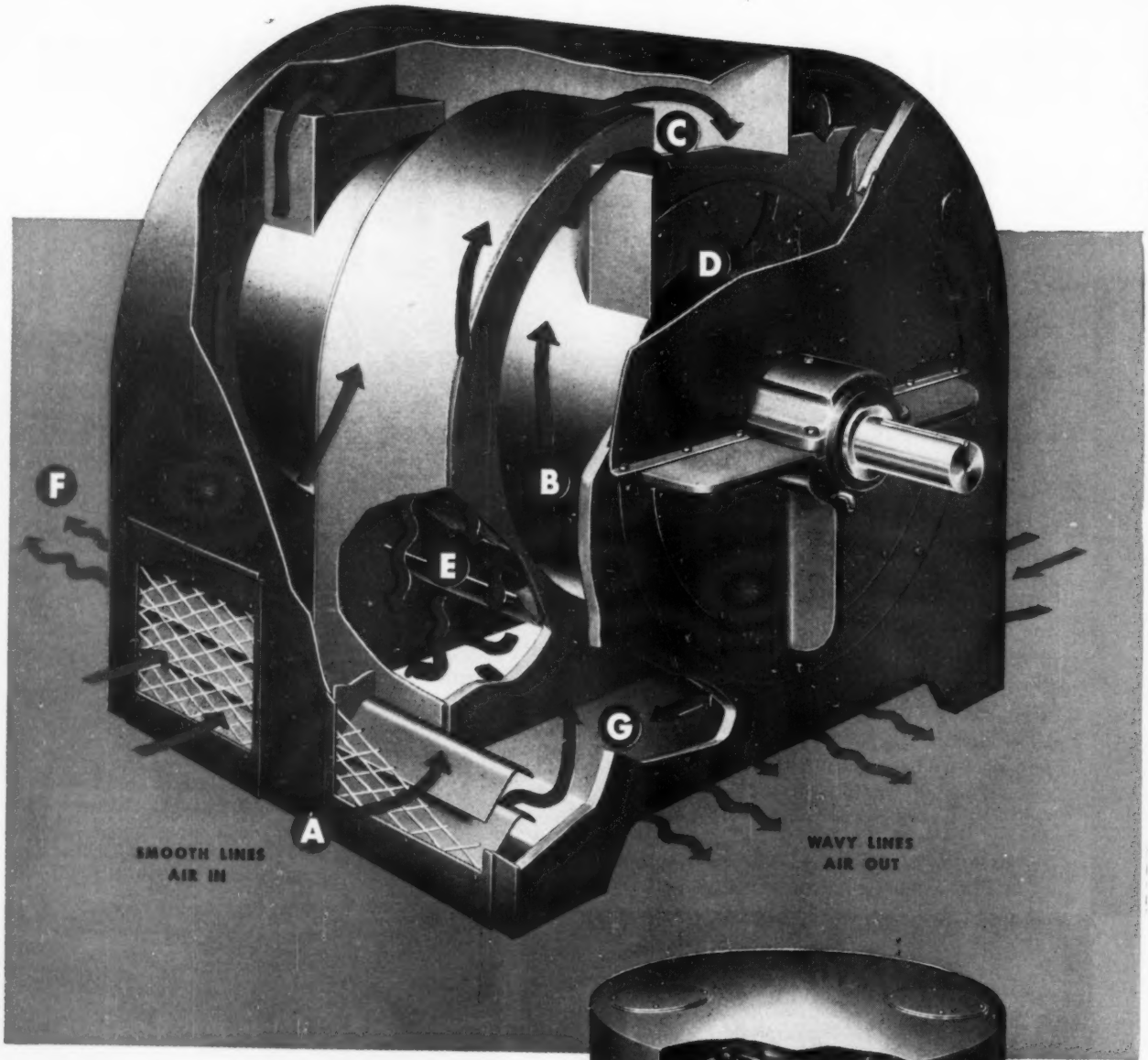
UNATIONS PHOTOS

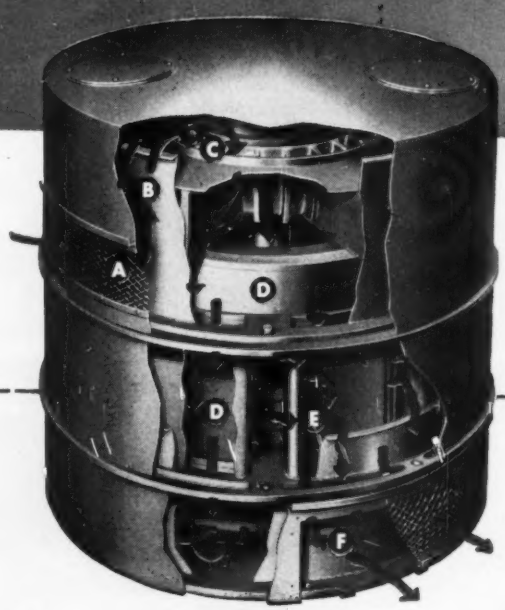




EZRA STOLLER PHOTOS







VERTICAL OUTDOOR MOTOR

New Outdoor Motor

dares weather to do its worst!

You can install these induction motors outside—any place—and forget the weather. They're naturals for power station auxiliary service, in fact, any place where a motor must stand up to weather—wind, rain, or hail as long as the ventilated openings are unobstructed.

Look at the cutaway drawing at the left. You can see that the motor is completely enclosed by a steel shell. Note how air enters the shell at the bottom (A), flows up and around in the motor shell (B), to top (C), where it is drawn down and into the interior of the motor (D). Warm air is discharged from motor (E) and out enclosure ends (F).

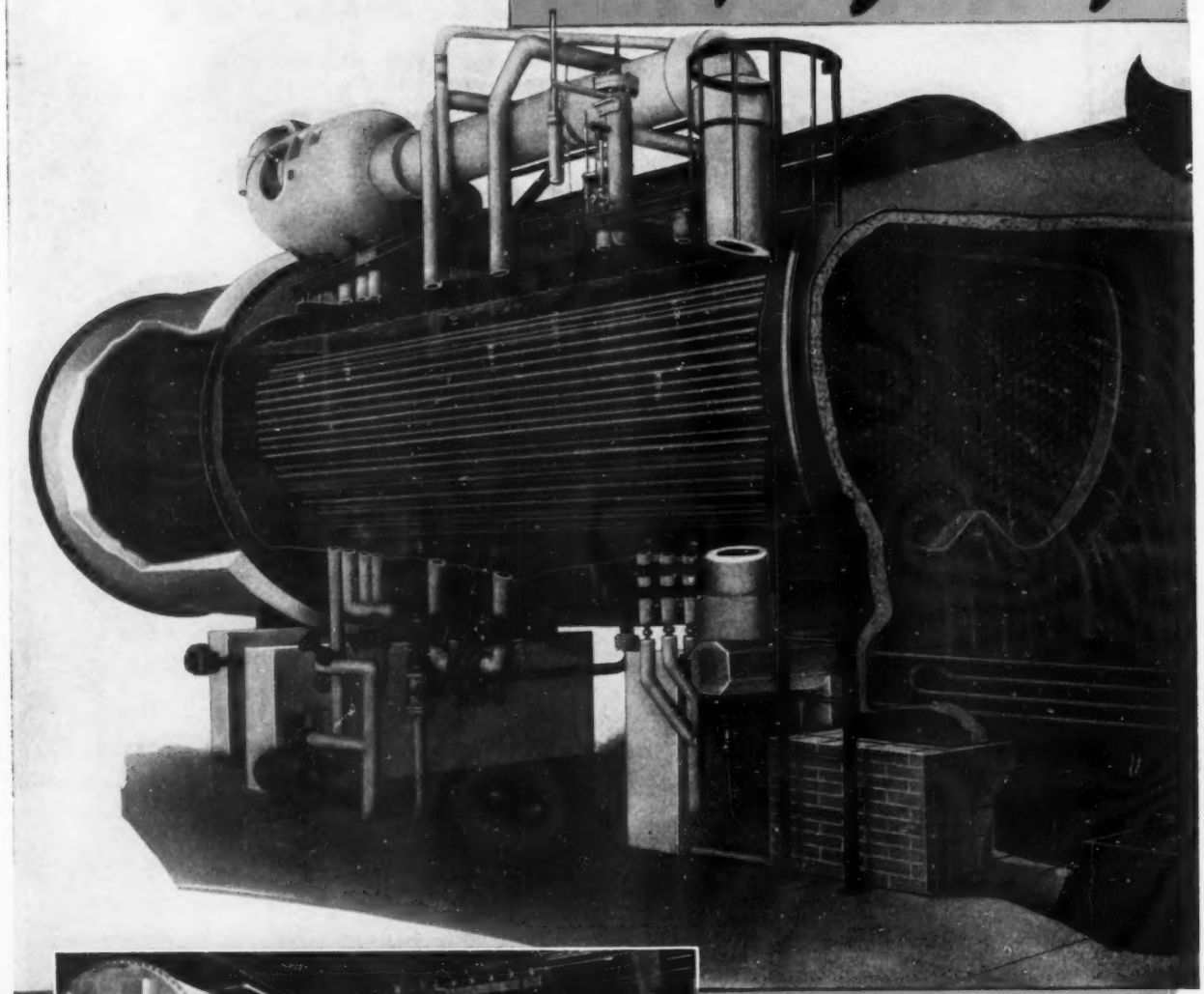
Now, what happens when moisture, rain and sleet are present in the air? The air is drawn in at point (A). As the air rises at a slow velocity, water, sand and other heavier-than-air particles fall to base (G) where a drain carries them away. Result? Regardless of outside conditions, only clean dry air enters the motor.

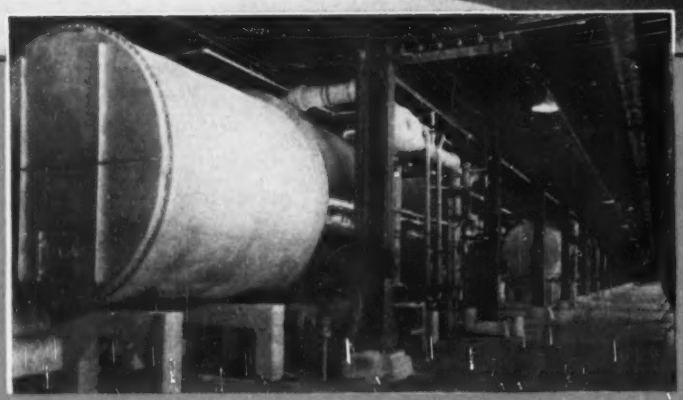
Remember, too, this motor includes features that have made Westinghouse Induction Motors leaders in industry. For example: Sectional covers and air shields, easily removed by hand. Split bearing housings, with bearings readily accessible for inspection or replacement. Sturdy welded steel frame; stronger, lighter, smaller.

Also, vertical-type outdoor motors are available with features that have made Westinghouse motors leaders in industry.

Get the facts now for immediate use or with an eye toward future requirements. See your Westinghouse representative or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-10375

Stop Giving





10 Erie City Fire Tube Boilers each "fired by" waste heat gases from an Open Hearth Furnace

Boilers (10) . . Erie City Fire Tube

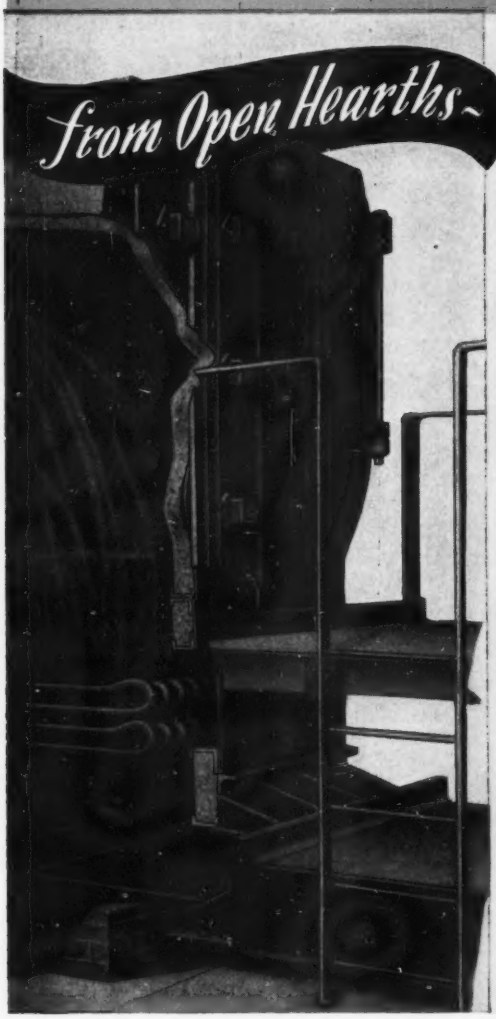
Design Pressure . . . 300 p. s. i.

Capacity . . . . 15,000 lbs/hr.

Superheater Steam Temperature . . . 525° F

Fuel . . Waste gases from Open Hearth furnace enter boiler at about . . . . 1200° F

WASTE HEAT a free ride



or from your

- Nickle Furnaces
- Zinc Furnaces
- Copper Furnaces
- Cement and Lime Kilns
- Incinerators
- Ore Roasters
- Silicate Furnaces
- Chemical Industry Furnaces
- Paper Industry Furnaces

IN these days of increased operating costs investigate the economy of waste heat recovery. A large steel producer tapped a source of wasted B.t.u.'s from 10 Open Hearths and converted them into 150,000 lbs. of 525° superheated steam per hour. Fuel is the big cost in steam generation; therefore "free fuel" will give you a head start in your steam generating program.

Erie City manufactures a complete line of fire tube and water tube waste heat type boilers and has wide experience in heat recovery.

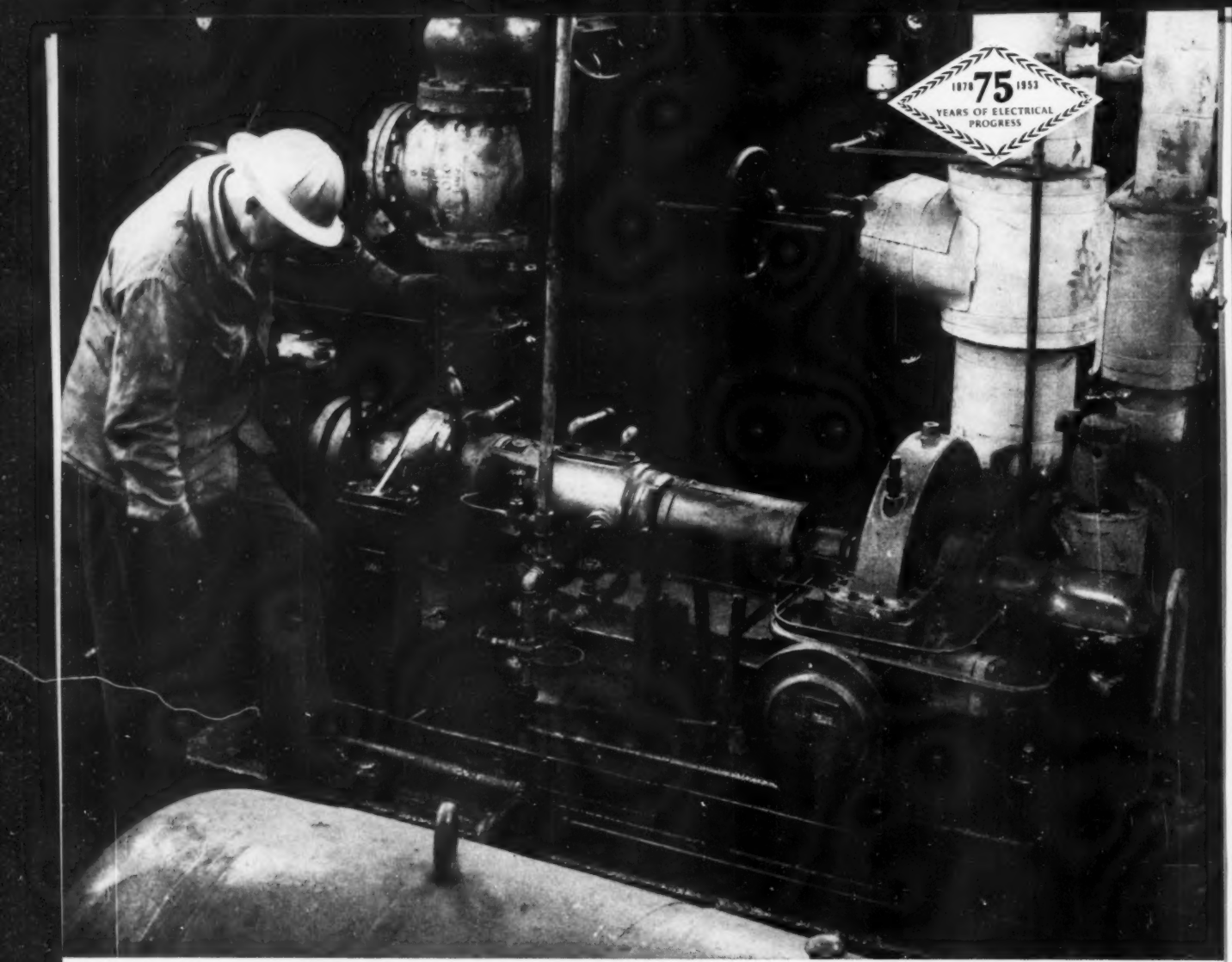
Outline your waste heat conditions—our experience is yours for the asking.

ERIE CITY
112 Years in Steam Generation

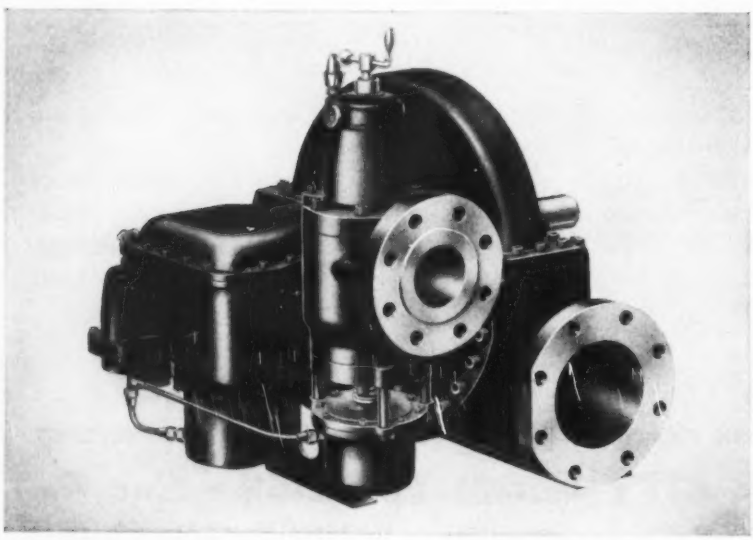
You can depend on Erie City for sound engineering

ERIE CITY IRON WORKS • *Erie, Pa.*

STEAM GENERATORS • SUPERHEATERS • ECONOMIZERS • AIR PREHEATERS
UNDERFEED AND SPREADER STOKERS • PULVERIZERS



Mr. A. Bourgeois, process foreman at Sohio Refinery, adjusts pump valve. Type DP-20, 125 hp turbine increased by 75% the oil thru-put of this pump which supplies crude oil for the distillation unit.



Type DP MECHANICAL-DRIVE TURBINE

This Type DP turbine is one of General Electric's line of mechanical-drive turbines designed for driving pumps, compressors, blowers, etc. Their sturdy construction and many safety features make them ideal for industries having process steam requirements.

At Sohio's Toledo Refinery, this 15 hp, Type DP-16 turbine with non-sparking enclosed overspeed governor, safely pumps propane in an explosive atmosphere.

Mr. Eugene Ten Eyck and Mr. E. J. Bissonnette of Sohio Refinery discuss stocking of interchangeable parts for the Type DP turbines installed at the Refinery.

Sohio Refinery picks G-E turbine drives to increase oil thru-put

Engineers at Sohio's Toledo Refinery installed two G-E mechanical-drive turbines to help eliminate a bottleneck in refinery operations. A General Electric Type DP-20 turbine increased oil thru-put on one pump at Sohio by 75%, when it replaced older drive equipment. Total daily thru-put of the one pump now equals the former capacity of two pumps.

INSTALLED IN HAZARDOUS AREA

Sohio also installed a G-E Type DP-16 turbine in an explosive atmosphere to pump almost pure propane. The enclosed, non-sparking overspeed governor and the positive trip-throttle valve (which shut off all steam flow in case of overspeed) reduce hazards in this area. The turbine, which operates twenty-four hours per day, has required no maintenance during its first year of service.

VIBRATION REDUCED

Replacement of previous drive equipment with a G-E turbine now assures longer life to other machinery in the area. For G-E turbines with their center-line support and rigid assembly of buckets are now contributing to smooth operation at the refinery.

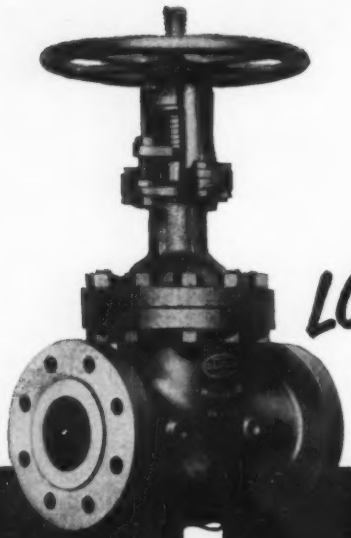
INTERCHANGEABLE PARTS

Use of G-E standard turbines can make stocking of spare parts a simple matter—most replacement parts are interchangeable among various frame sizes of G-E Type DP turbines. Stocking costs are cut, yet parts are available when needed.

This same parts standardization adds to the turbine's flexibility—often the turbine can be adapted to a new plant application with only minor adjustments. Horsepower range can be changed by substituting a different nozzle plate and valve parts.

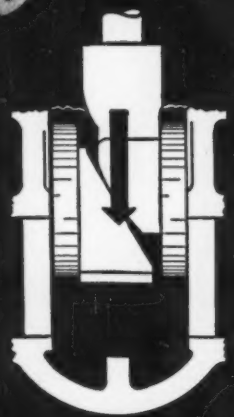
For more information about the many advantages which these standardized turbines offer, call in your G-E sales-engineer or write for bulletin GEA-4955A, "A New Standard in Mechanical-drive Turbines." Section 252-56, General Electric Company, Schenectady 5, New York.

GENERAL ELECTRIC

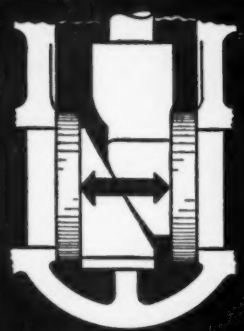


Look how you gain LONGER, TROUBLE-FREE VALVE LIFE

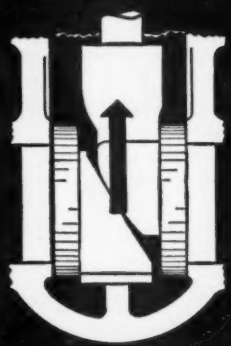
with Darling revolving disc gate valves*



DESCENDING. Fully revolving discs, independently hung, change seating position at each closing, assuring uniform wear distribution for prolonged service. Plain "no pocket" discs are interchangeable for *extra* life!



CLOSED. Faces of upper wedge are radiused and faces of both wedges are transversely beveled for equalized wedging pressure and *tight closing despite valve body distortion.*



RISING. Wedging pressure on both discs is released before discs start to rise. Complete absence of wedging pressure during travel of discs assures easy operation, tight closing and greatly prolonged valve life!

***DARLING REVOLVING DISC GATE VALVES FOR EVERY NEED...**

These unique valves are available in iron, bronze, steel, special corrosion-resistant alloys and combinations, and in a broad range of sizes, for all kinds of normal and unusual services in pressures up to 1500 pounds. Before you buy gate valves of *any* type, find out what you stand to gain by using the proper Darling valves. Simply outline your service requirements and ask for a free, descriptive bulletin.

DARLING VALVE & MANUFACTURING CO.

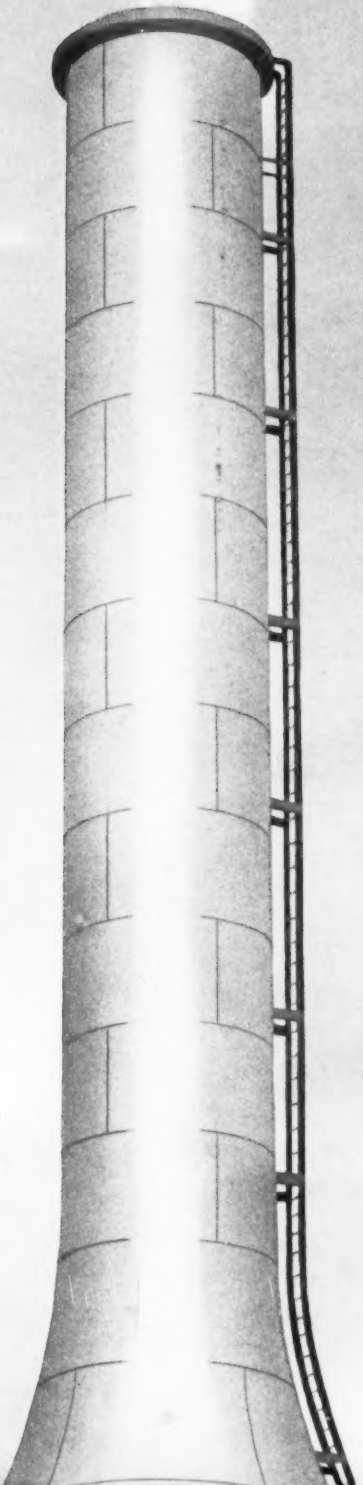
Williamsport 8, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ontario.

DARLING TRADE DARLING MARK VALVES

FOR PLUS VALUES, JOB-PROVED AGAIN AND AGAIN

American Blower . . . a time-honored name in air handling



Look at the almost total absence of fly ash from this stack. This is due to an American Blower Fly Ash Precipitator. On a given application, as the load falls off and fly ash becomes harder to catch, this precipitator automatically maintains a higher efficiency than any other collector of mechanical type.

AMERICAN BLOWER

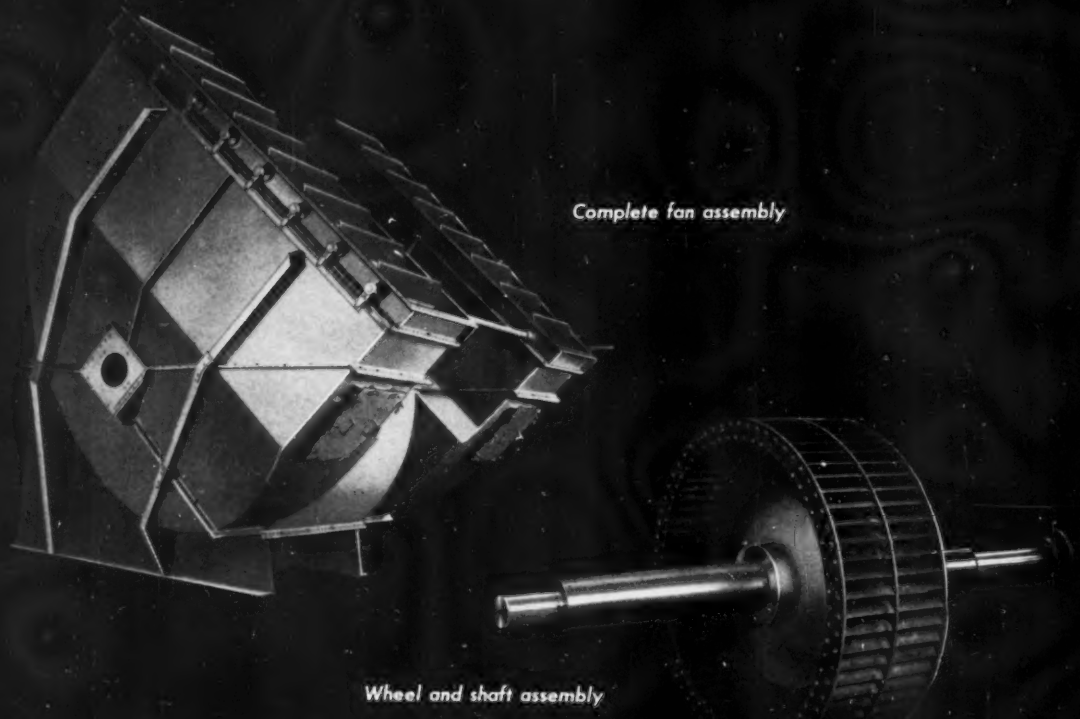
AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary corporation

Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS & WALL TILE · DETROIT CONTROLS · KEWANEE BOILERS · ROSS HEATER

American Blower . . . a time-honored name in air handling



Complete fan assembly

Wheel and shaft assembly

SIROCCO INDUCED DRAFT FAN

Memo to Power Plant Men:

You can handle more gas per revolution at lowest tip speed with Sirocco Multi-Blade Fans than with any other type. Designed and proportioned especially for induced draft work, their operating characteristics make them particularly adaptable to your modern power plant needs.

AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
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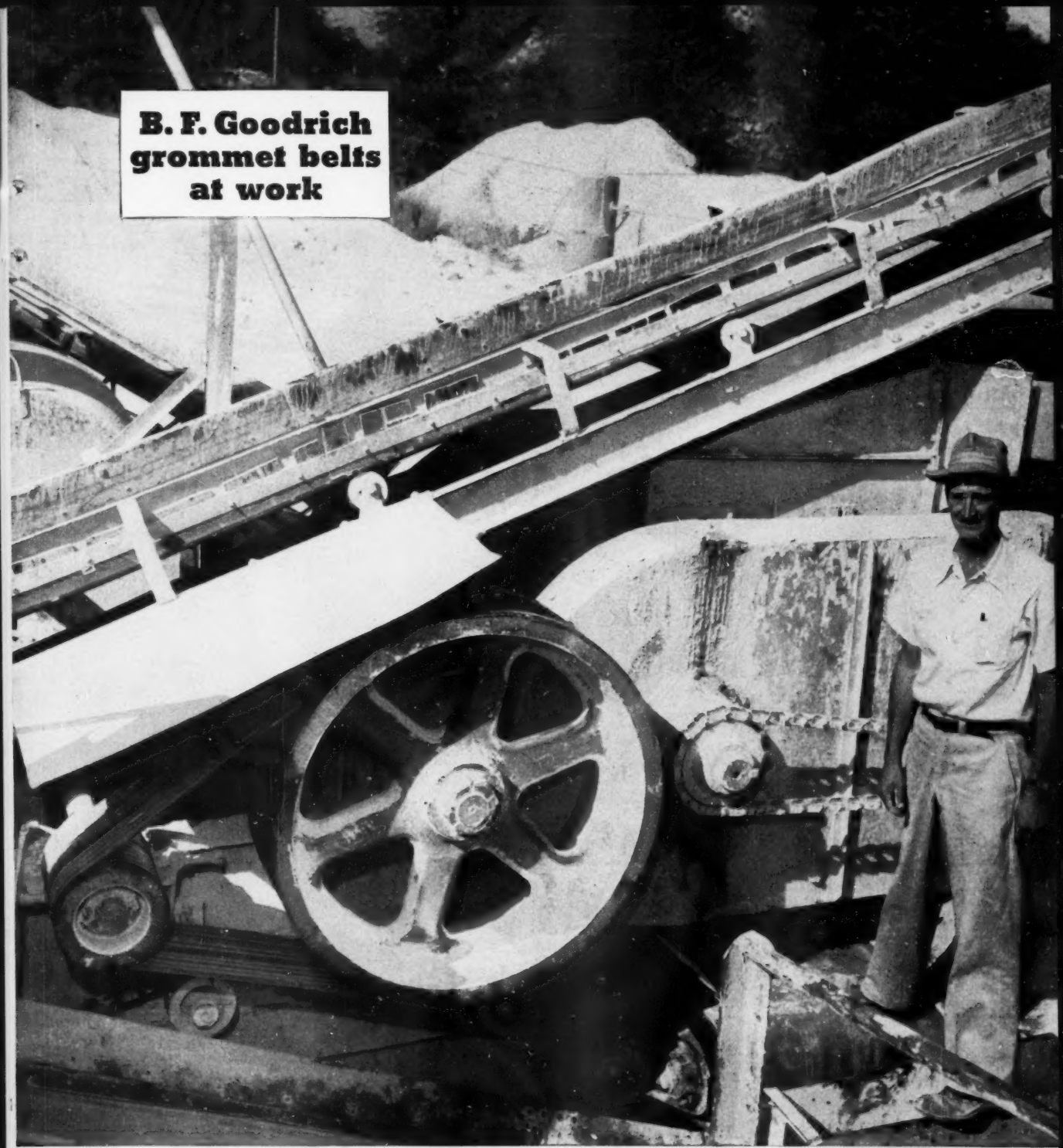


Crushing chunks of limestone to a fine powder for agricultural lime creates dust so thick and white it looks like snow.

Limestone snow—slippery driving

In this quarry, a series of moving rubber belts, something like a roller coaster, carries limestone from crusher to crusher until the stone is reduced to powder. V belts keep the rubber roller coaster going. But crushing the limestone creates dust, and that mixed with the slightest bit of moisture makes the sheave surfaces so slick that ordinary V belts couldn't grip them. Belts would slip, burn, soon wear out. To find out how this problem was solved, see the following pages.

Limestone snow (continued)

It's slippery driving for belts running in limestone snow at Carthage Marble Corporation, Carthage, Missouri.

A B. F. Goodrich distributor solved the slippage problem described on the preceding page when he installed a set of grommet V belts. Grommet V belts are built to handle heavy loads, yet are more flexible, so they don't slip or stretch as much as ordinary belts. In this case, they put an immediate stop to the slipping, and last 20% longer than the belts used before. Here's why B. F. Goodrich grommet belts outlast and outperform ordinary V belts.

20 to 50% longer life

Grommet V belts, made only by B. F. Goodrich, represent the only basic improvement since invention of the

V belt. Belts last 20 to 50% longer, depending on the service. (The more severe the service the greater the increase over ordinary belts.)

What is a grommet?

A grommet is like a giant cable except that it's endless—a cord loop built up by winding heavy cord on itself. There is no overlapping cord *section* as in all ordinary belts. Most belt failures occur in these sections where cords overlap!

All cords put to work

In ordinary belts under high tension the center cords "dish" and tension is greater near the driving faces. Dished cords are doing less work, not pulling their share. Each grommet and every part of a grommet carries its share of the load. Grommet V belts have no center cords—therefore much more strength in proportion to cord volume.

Better grip, less slip

Grommet V belts have more rubber in relation to belt size. Without any stiff overlap, they're more flexible, grip pulleys better. Size for size, grommet belts give ⅓ more gripping power, pull heavier loads with a higher safety factor. Because there is less slip there is also less surface wear.

They cost no more

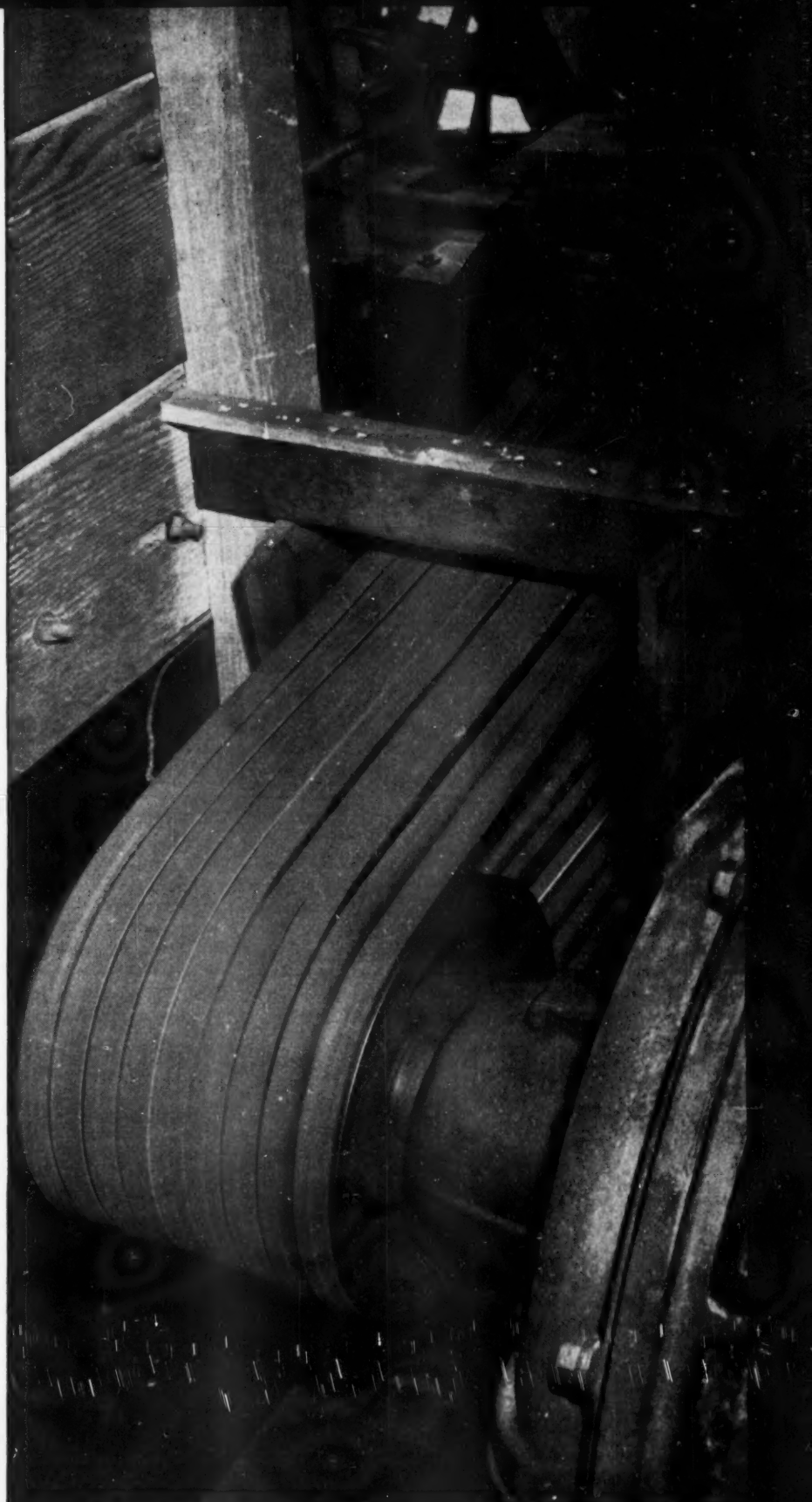
You save belt costs because belts last longer, save production costs because machines keep running with fewer interruptions, save maintenance costs because they need less attention, yet cost not one cent more than others. Grommet belts are made in C, D and E sections. Only B. F. Goodrich makes the grommet V belt.

See "X-ray" Belt

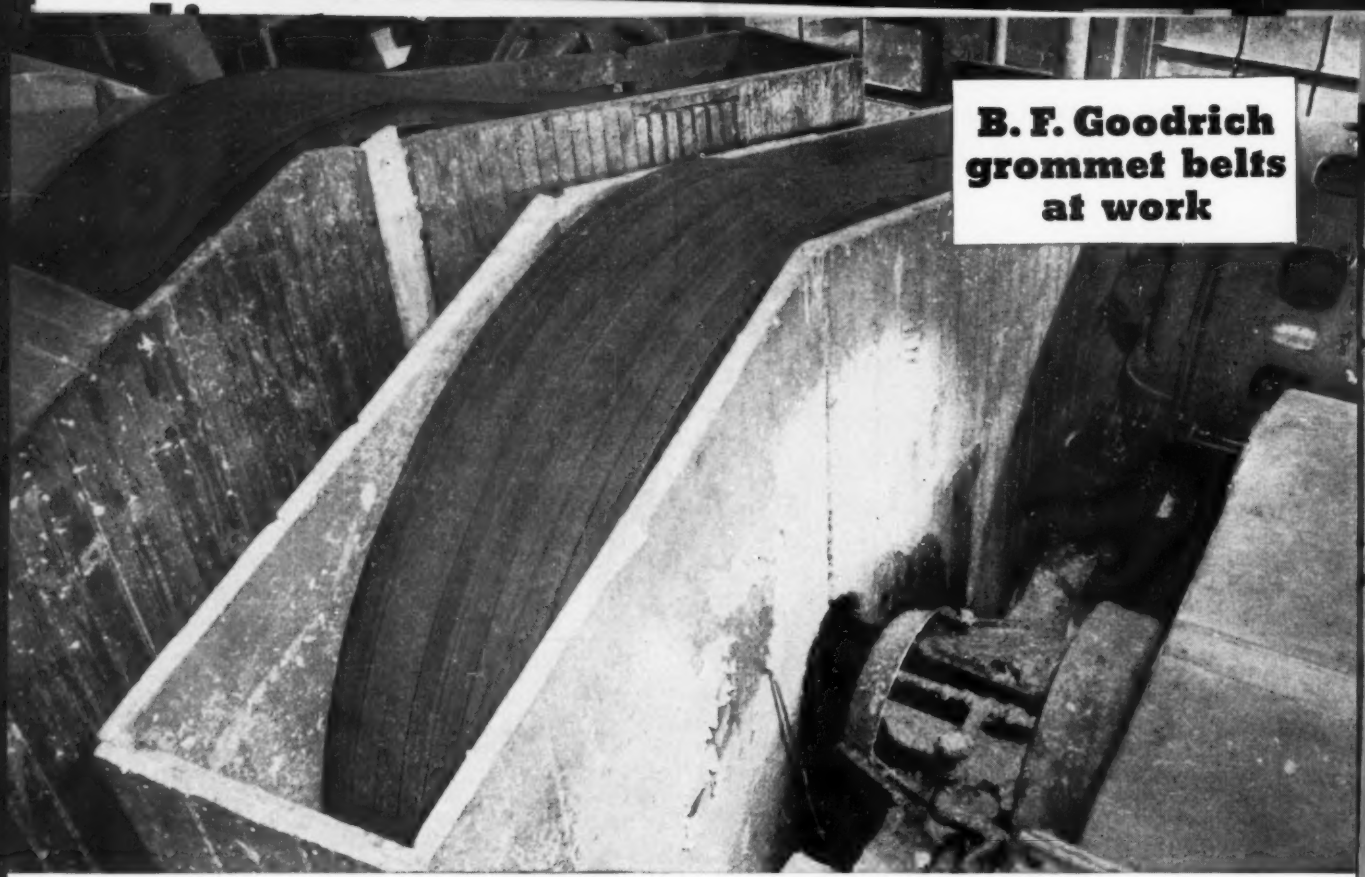
A special demonstrator "X-ray" belt has been made to show the grommet construction. Ask your local B.F.Goodrich distributor to show it to you.

Space savers

These belts run a sand pump on a barge. Flat belts, previously used, were lasting only 12 months, replacement costs were high, and the drive took too much space. Then a B. F. Goodrich distributor suggested a switch to grommet V belts. The changeover not only saved valuable space, but also cut belt costs as the grommet V belts have already run 36 months, and are still going strong.



Belt service tripled when they switched to grommet V belts.



V belt failures used to cause plant shutdowns, slow up production at Westfield Paper Co., Russell, Mass.

Eliminate paper wait

Ordinary V belts on these drives lasted only a year. They couldn't take the 24-hour service, the heavy load running the pulp beaters. Covers would separate from the belt, flap around the drive, get caught in pulleys, finally tear off completely.

A BFG distributor heard of the trouble and recommended grommet V belts. It proved to be a perfect solution. Installed in 1941, both sets of grommet V belts have already outlasted other belts by *10 years*, and still look good for years' more service.

These typical examples (see preceding pages) tell you why B. F. Goodrich grommet belts are superior to ordinary V belts—prove they last 20 to 50% longer—yet cost no more.

The B. F. Goodrich Company
Department PO
Akron, Ohio

☐ Please have a BFG distributor call on me to discuss grommet V belts.

☐ Send set of reports telling users' experiences and showing actual installations where grommet belts outlasted all others.

Name_____

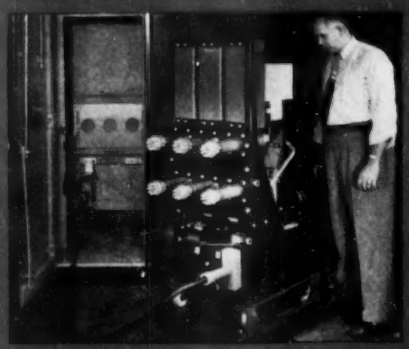
Title_____

Firm Name_____

Address_____

City_____ State_____

Grommet V Belts BY
B.F.Goodrich
FIRST IN RUBBER



Test jumper facilitates breaker inspection, operation and maintenance at the station site.

Hard-to-get-at undersurfaces are protected against rust and corrosion by a heavy-rubberized sealing material.

Install Switchgear Outdoors

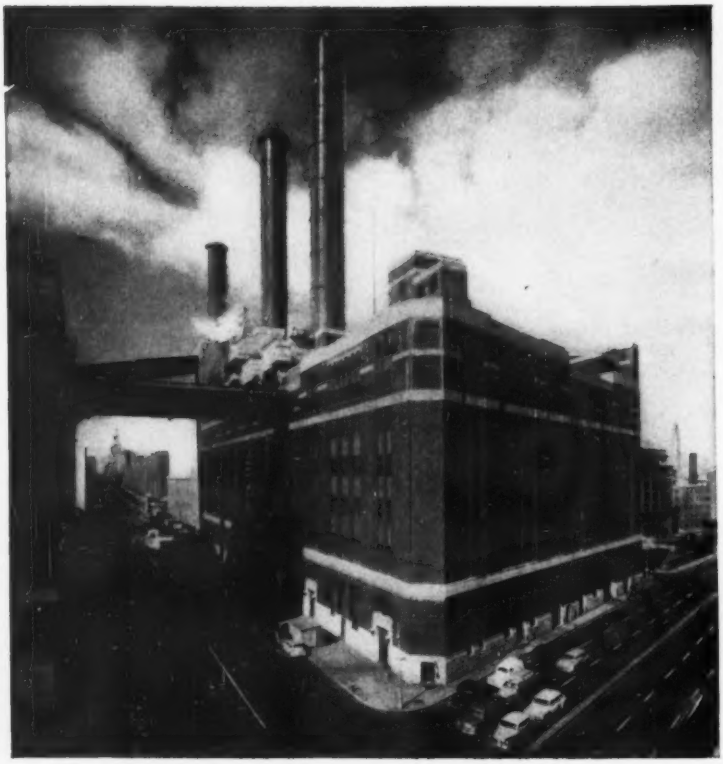
GET CONVENIENT OPERATION PLUS COMPLETE PROTECTION

When building-cost considerations suggest outdoor switchgear installations, you'll naturally want equipment that can be most conveniently operated and maintained in the open . . . and weatherproofed to protect against rust and corrosion. Westinghouse Outdoor Metal-Clad Switchgear meets these specifications.

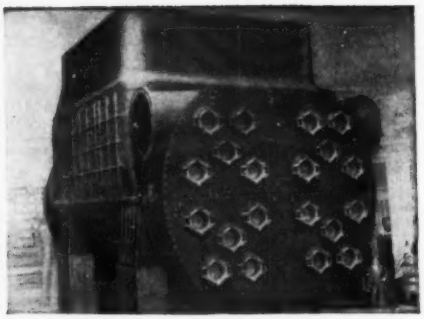
Convenient Operation and Maintenance — Easily operated horizontal drawout circuit breakers eliminate lifting and lowering. A few turns of a crank connect or disconnect the breaker. Breakers of like rating are interchangeable and are easily rolled on the adjustable-height transport truck with its combination latching device for breaker and stationary structure.

Weatherproof Construction—Utilizing rigid, self-supporting, jig-welded construction features, Westinghouse Outdoor Metal-Clad Switchgear is equipped with a weatherproof housing, special underframe or base, and access doors at both front and rear of the unit. Space heaters and special ventilators in each unit reduce the possibility of condensation. As long-term protection against rust and corrosive elements, the metal frame is Bonderized, prime and finish painted, and the base receives a heavy spray application of all-weather undersurface coating.

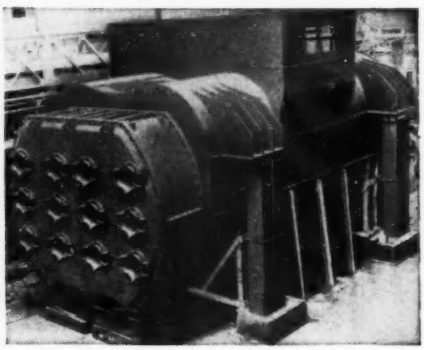
For complete facts on outdoor or indoor metal-clad switchgear, write for Booklet 5306. Address: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60793



CON EDISON'S EAST RIVER ELECTRIC GENERATING STATION at 14th Street, New York City, will contain the new Worthington 125,000 sq-ft condenser. The shell, which is to be installed under 160,000-kw Unit No. 7, will contain nearly 105 miles of ¾" O.D. aluminum brass tubes and will require 138,000 gpm of East River water supplied by two 54 in. Worthington "Mixflo" vertical single suction volute circulating pumps.



WORTHINGTON CONDENSER installed in 1931 to serve 160,000-kw Unit No. 7, Hudson Avenue Station. Tube sheets were drilled for 110,000 sq ft with 101,000 sq ft installed.



ONE OF TWO 74,500 SQ-FT 2-PASS WORTHINGTON CONDENSERS serving 60,000-kw Units 14 and 15 at Waterside Station No. 1.

Con Edison once again installs "largest" condenser

On several occasions over the past fifty years, Worthington has been selected to build the "world's largest" surface condensers in single shell design.

In 1919, a 70,000 sq-ft condenser was installed under a 35,000-kw turbine-generator for a prominent utility company. This was the largest single shell surface condenser of its day.

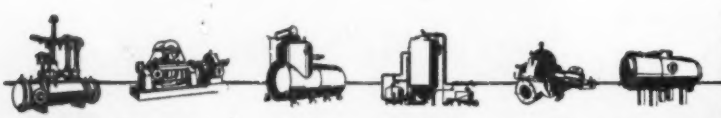
In 1931, Brooklyn Edison Company (now Consolidated Edison Company of New York, Inc.) installed, under 160,000-kw Unit No. 7 at the Hudson Avenue Station, the "world's largest" at that time, a 101,000 sq-ft single-pass Worthington condenser. This was followed, in 1949, by two 74,500 sq-ft condensers for Waterside Station No. 1.

Now, Worthington is again building for Con Edison the "world's largest" single-shell condenser ever ordered, 125,000 sq-ft, single-pass, for the 160,000-kw Unit No. 7 addition to East River Station.

Worthington, with over a century of experience in the manufacture of steam power equipment, is prepared to build efficient condensers in all sizes. Let us advise you, without obligation, on your new installation.

Write, stating requirements, to *Worthington Corporation, Steam Power Division, Harrison, New Jersey.*

Z.2.2



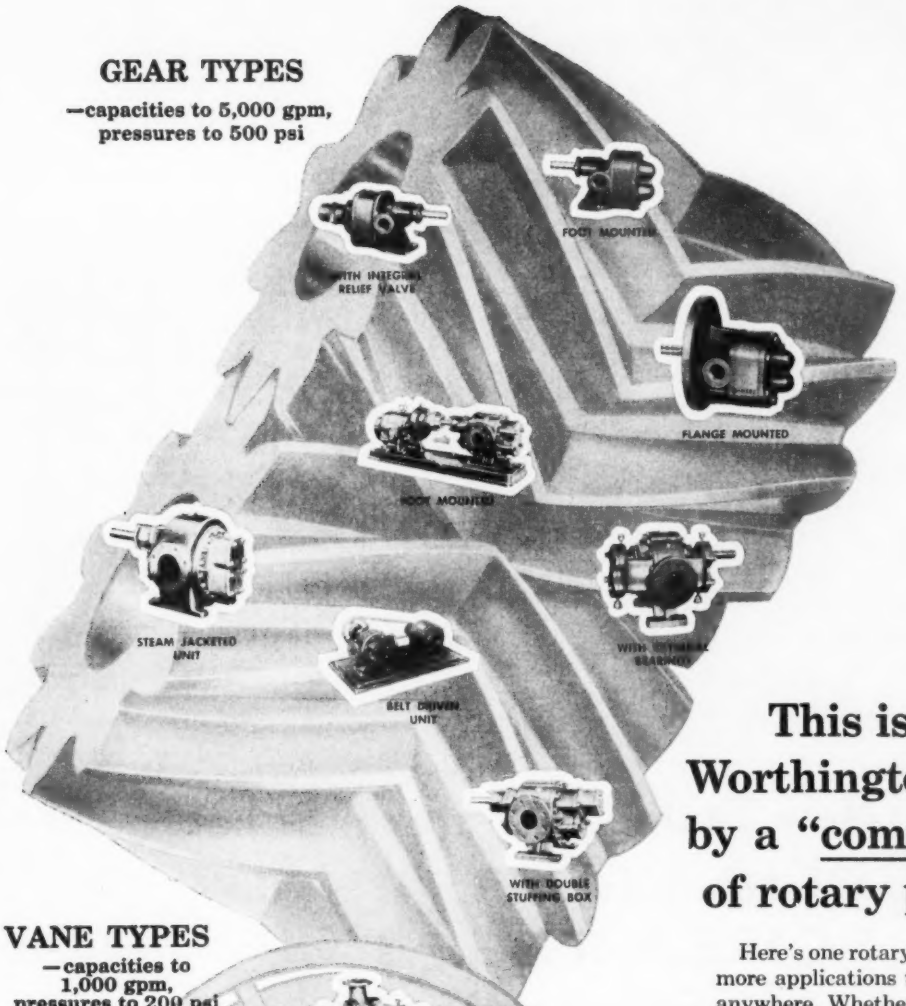
World's Broadest Line of Steam Power Plant Auxiliaries

WORTHINGTON

Condensers

GEAR TYPES

—capacities to 5,000 gpm, pressures to 500 psi



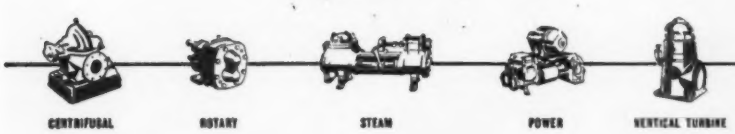
VANE TYPES

—capacities to 1,000 gpm, pressures to 200 psi

This is what Worthington means by a "complete line" of rotary pumps...

Here's one rotary pump line that covers more applications than any you can find anywhere. Whether you pump thin, non-lubricating liquids or viscous liquids, small or large capacities, low or high pressures, with motor, turbine, engine, belt, or variable speed motor drive, there's a Worthington rotary that'll do your job. Units supplied with either conventional stuffing or mechanical seal. Write for Bulletin W-485-B1 on vane types; W-484-B1A (general service—capacities to 51 gpm, pressures to 100 psi), W-484-B2 (corrosive service—capacities to 51 gpm, pressures to 100 psi), and W-487-B10C (heavy-duty service—capacities to 5,000 gpm, pressures to 500 psi) all heavy-duty gear types. Worthington Corporation, Reciprocating Pump Division, Harrison, N. J.

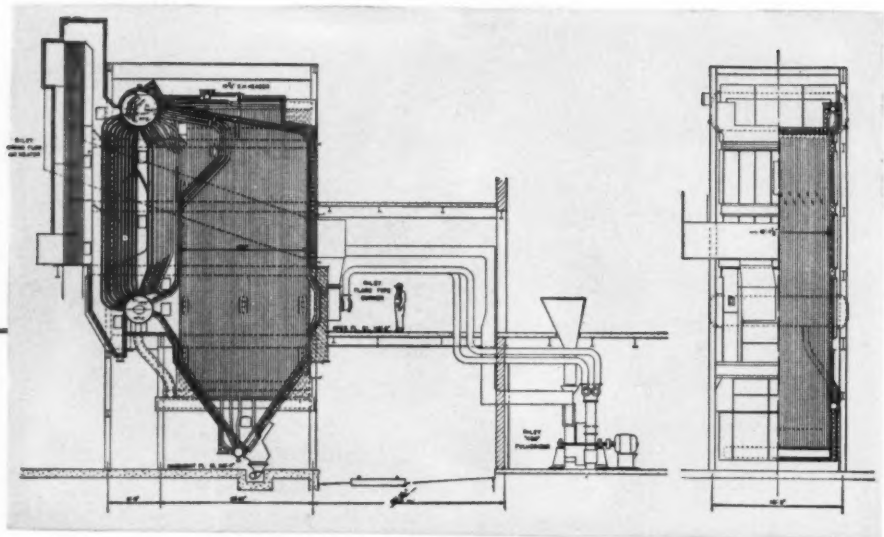
P.2.4



The World's Broadest Line Assures You the Right Pump for Every Job

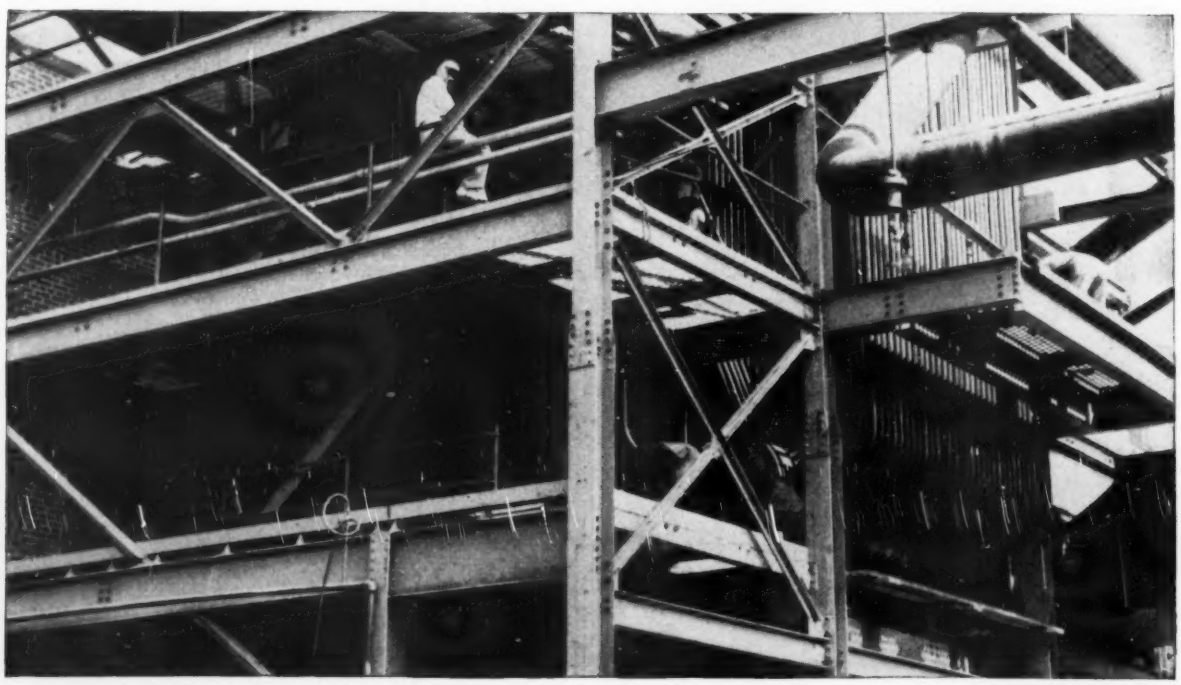
WORTHINGTON

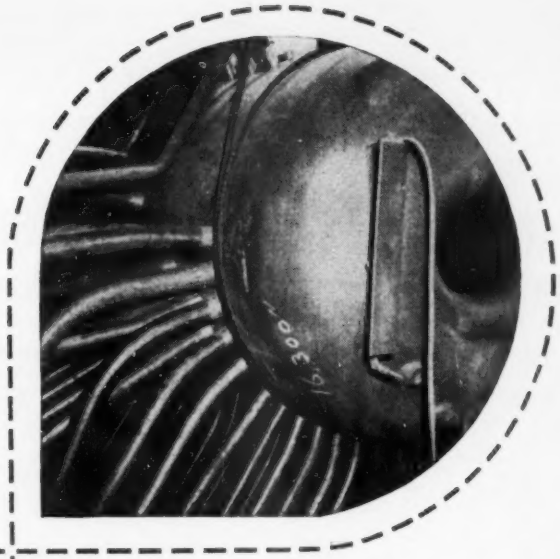
Rotary Pumps



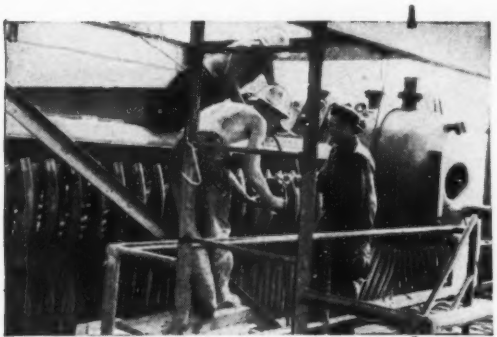
Riley Boiler for Trion Division of Riegel Textile Corporation, Trion, Georgia. Pressure: 450 psi. Output: 75,000 lb./hour at saturated temperature (future, 725°F.)

New Textile Mill Steam Boiler uses REPUBLIC ELECTRUNITE BOILER TUBES





Republic ELECTRUNITE *Tubes enter drum holes easily because tubes are scale-free. Scale-free ends eliminate costly grinding and result in a tighter bond between tube and tube sheet or drum.*



Erectors like the ease of inserting and roller-expanding Republic ELECTRUNITE *Boiler Tubes.*

The new boiler house addition at Riegel Textile Corporation, Trion Division, Trion, Georgia, during erection of the Riley Boiler.

Power and process steam for the Trion Division of the Riegel Textile Corporation will be produced in this new Riley Boiler, tubed with Republic ELECTRUNITE Tubes.

Republic ELECTRUNITE Boiler Tubes are made from flat-rolled steel carefully inspected on both surfaces before roll-forming. Walls of the tubes are uniform in thickness . . . thus heat transfer is uniform all around the tube and from end to end.

Full-normalizing makes Republic ELECTRUNITE Boiler Tubes uniformly ductile for smooth bending and uniform roller-expanding. High-quality steel helps reduce the danger of localized pitting, promises longer life between retubings.

For your next boiler job, new or retubed, specify Republic ELECTRUNITE Boiler Tubes. Write for booklet which gives data and specifications.

STEEL AND TUBES DIVISION
REPUBLIC STEEL CORPORATION
221 EAST 131st STREET • CLEVELAND 8, OHIO

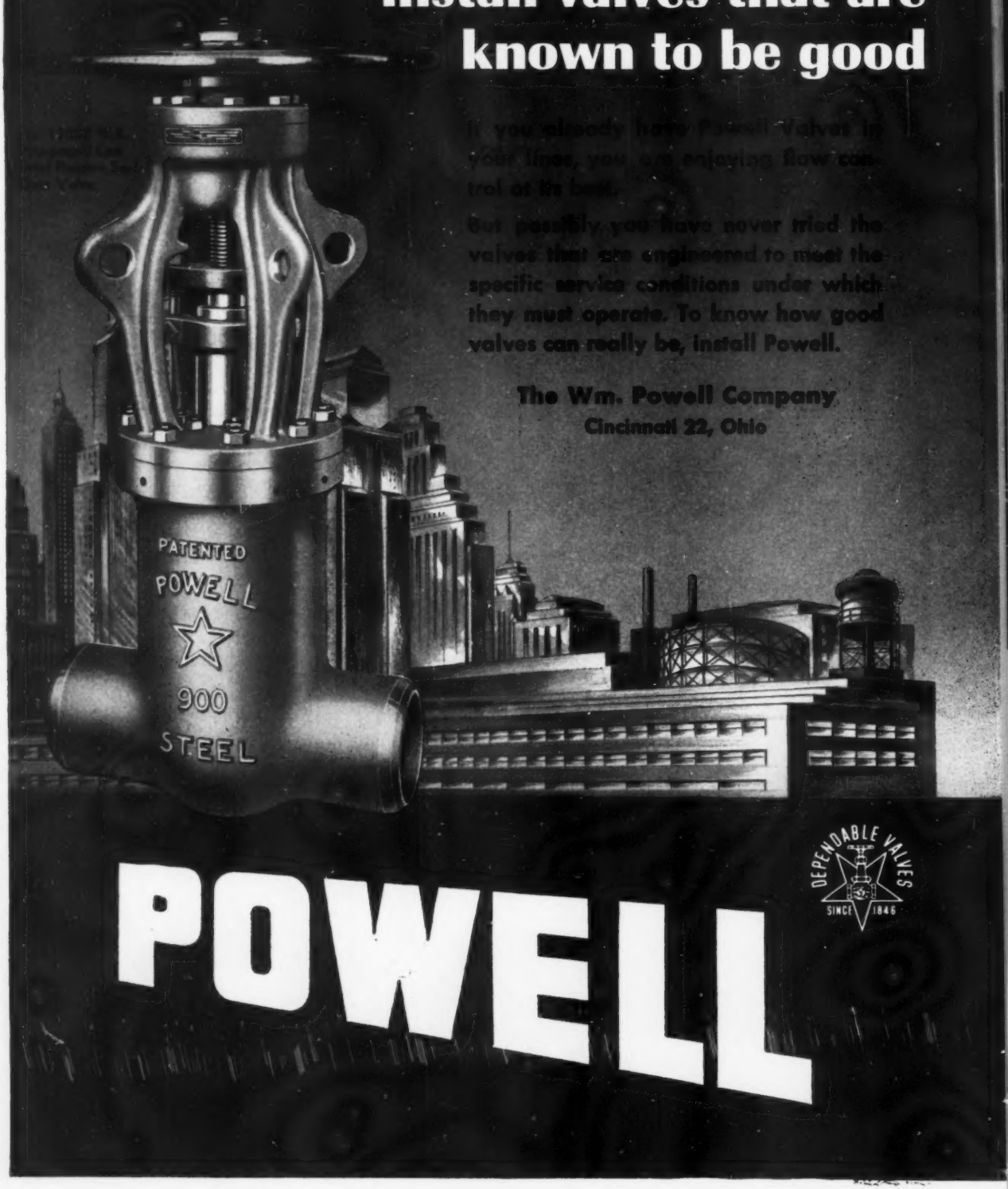
REPUBLIC STEEL

Republic

ELECTRUNITE

ELECTRUNITE—The Original Electric Welded Boiler Tube

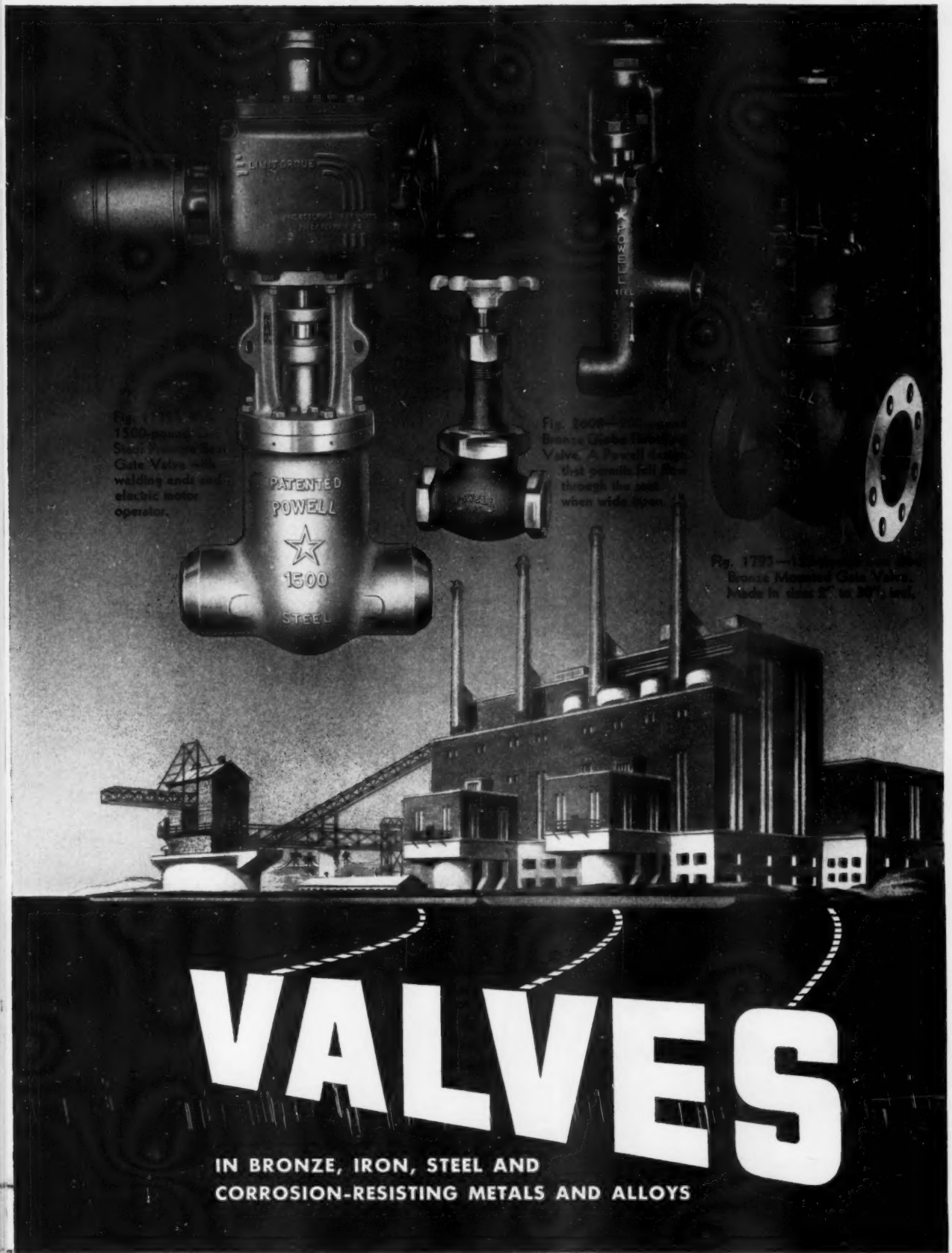
To know how good valves can be, install valves that are known to be good



If you already have Powell Valves in your lines, you are enjoying flow control at its best.

But possibly you have never tried the valves that are engineered to meet the specific service conditions under which they must operate. To know how good valves can really be, install Powell.

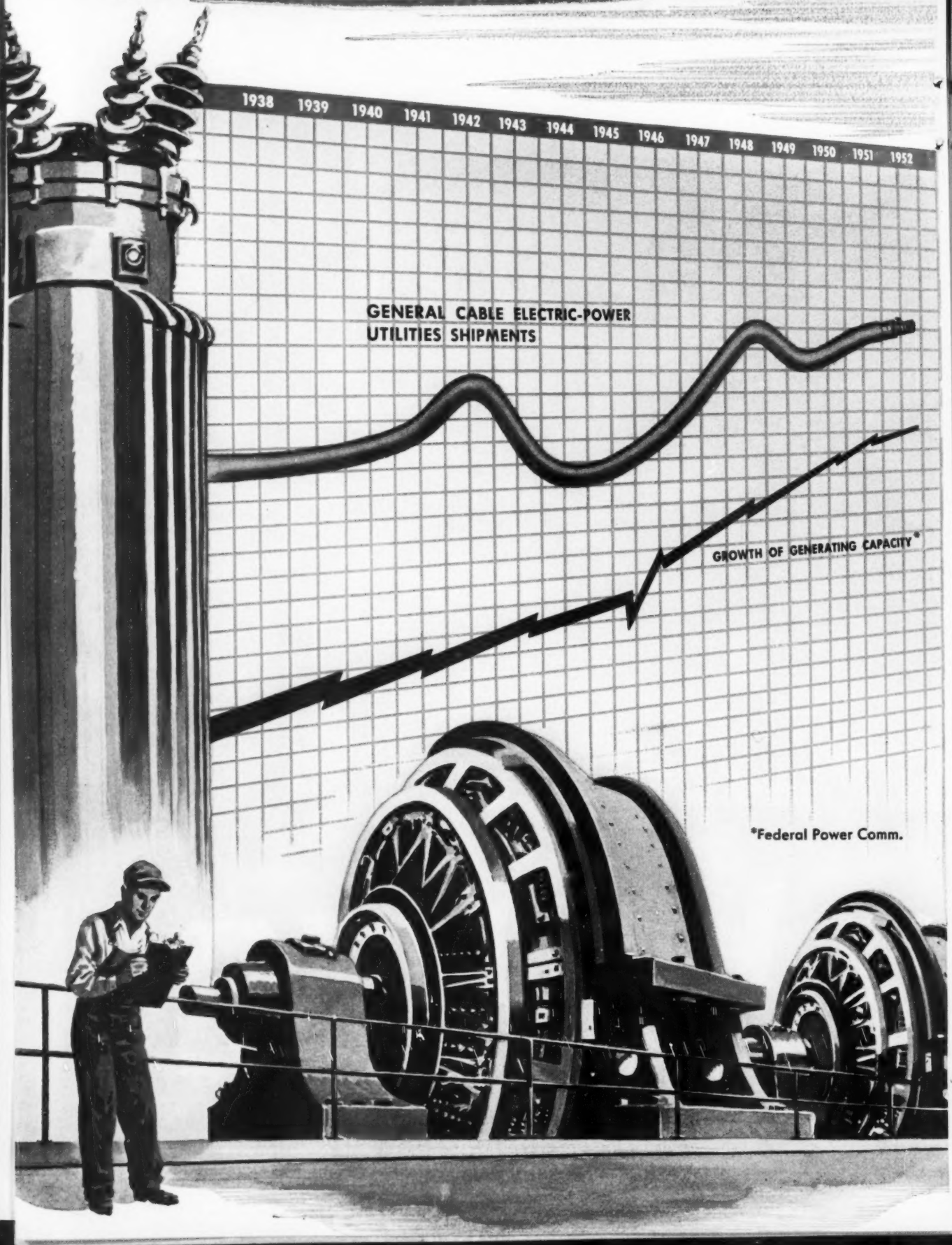
The Wm. Powell Company
Cincinnati 22, Ohio



VALVES

IN BRONZE, IRON, STEEL AND CORROSION-RESISTING METALS AND ALLOYS

AS GENERATING CAPACITY CONTINUES



TO EXPAND . . .

GENERAL CABLE

Continues to Grow ...and Serve

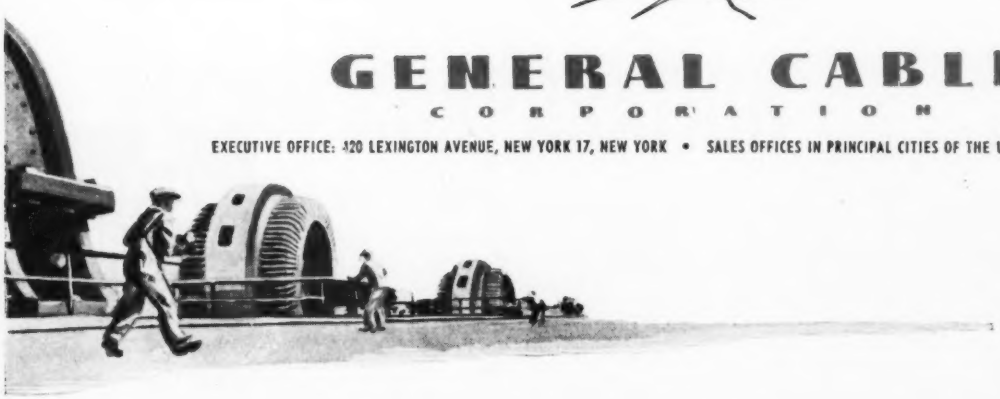
General Cable, like the utility industry itself, is geared to forecast trends and growth possibilities so that it may always be counted on as a dependable, progressive source of supply. Offering thousands of different wire and cable products of one standard of quality, General Cable's strategically located plants, warehouses and sales offices insure adequate supplies with swift service for every part of the country. We always have and will maintain this policy as power output demands.

For sure, dependable supply, call General Cable!

"More Power to You" ®

GENERAL CABLE
CORPORATION

EXECUTIVE OFFICE: 420 LEXINGTON AVENUE, NEW YORK 17, NEW YORK • SALES OFFICES IN PRINCIPAL CITIES OF THE UNITED STATES



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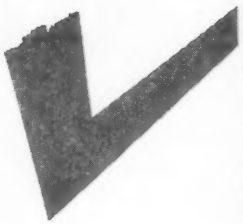
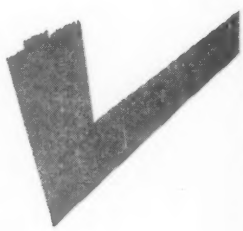


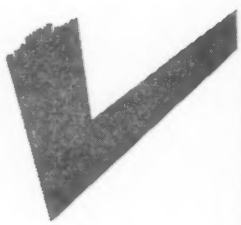
for using HAGAN

automatic combustion controls



and HAGAN

ring balance flow meters



HAGAN
HALL
BUROMIN
CALGON

It makes good sense to invest your dollars in Hagan Combustion Controls and Hagan Meters. The investment pays real dividends in the following ways:

accuracy

Hagan Automatic Controls and Ring Balance Meters are accurate, whether the system is simple or complex. This accuracy is reflected in savings which, during the life of the boiler, usually amount to many times the cost of the equipment.

dependability

Hagan Controls and Ring Balance Meters are dependable in their performance, year after year. Long life and low maintenance costs are inherent in all designs.

versatility

One boiler or many, one or more fuels, Hagan Controls handle the job easily. Hagan Ring Balance Flow Meters are the most versatile meters available for measuring and recording flow of liquids and gases.

Whatever your metering or combustion control problems, let Hagan Engineers help you solve them. Our experience is at your service. Write, or call us, at

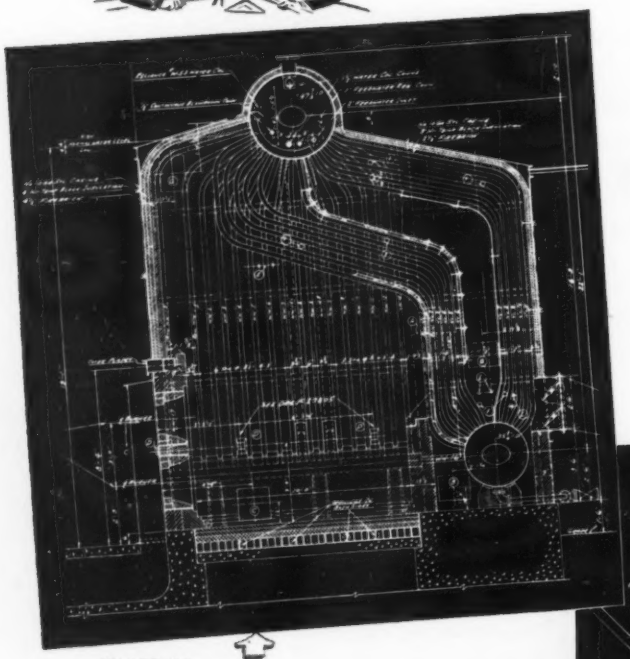
HAGAN CORPORATION

HAGAN BUILDING, PITTSBURGH 30, PA.

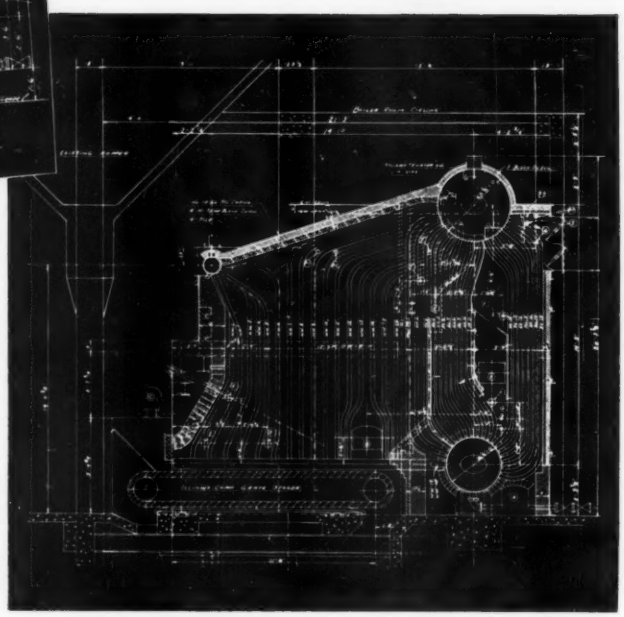
BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
CONTROL SYSTEMS FOR AUTOMOTIVE AND
AERONAUTICAL TESTING FACILITIES

Industry Approved

Two-Drum
STEAM GENERATORS
by Vogt



CLASS VF
A 22,000 pounds steam per hour unit installed at Indiana Farm Bureau Refinery, Mt. Vernon, Ind.



CLASS VS
The Seelbach Hotel, Louisville, Ky. is served by this 30,000 pounds steam per hour boiler.

A wide variety of industrial plants and other users of steam for power, processing, or heating have found these efficient Vogt Two-Drum Type Boilers to be the answer to their diverse steam generating requirements.

Class VF units provide maximum capacity in limited floor space and head room, while Class VS is best adapted to installations not having such restrictions. Each has a large furnace volume and a high ratio of radiant heating surface. The furnace design assures proper combustion of fuels fired in suspension or with various type of stokers.

A bulletin with general information and showing typical installations is available on request.

Typical Users...

FOOD PROCESSING PLANTS

DISTILLERIES • HOTELS

HOSPITALS • CHEMICAL PLANTS

PETROLEUM REFINERIES

HENRY VOGT MACHINE CO., Louisville 10, Kentucky

BRANCH OFFICES: NEW YORK, PHILADELPHIA, CLEVELAND, CHICAGO, ST. LOUIS, DALLAS, CHARLESTON, W. VA.

Corrosion won't hurt this TRI CLAD motor's cast-iron frame

REG. U.S. PAT. OFF.

HERE'S A COMMON SIGHT AROUND MANY PLANTS— A G-E Tri-Clad motor operating reliably and continuously under the extremely corrosive conditions that cause many other motors to fail.

THAT'S WHY YOU CAN EXPECT superior performance from G-E Tri-Clad motors. Consider these facts:

CORROSION-RESISTANT CAST-IRON means longer motor life. Unlike steel, cast-iron resists corrosive pitting, even when the paint is chipped.

RIGID, CAST STATOR FRAME with integrally cast feet, can't be twisted out of line by accidental jarring or by excessive "bolt-down" pressure on the feet.

STRONG, CAST-IRON END SHIELDS have cast ribs for extra strength without adding extra weight . . . protect the true motor alignment even under heavy shaft loads.

ORDER G-E TRI-CLAD MOTORS from your nearby G-E Apparatus Sales Office or G-E Agent or distributor. General Electric Co., Schenectady 5, N. Y. 752-19

You can put your confidence in

GENERAL ELECTRIC

MODERN G-E BOILER FEED PUMP MOTORS ARE INSTALLED IN NIAGARA MOHAWK'S NEW ALBANY POWER STATION.

IN DESIGN AND PERFORMANCE—

A True Power Station Motor

When side-air-discharge motor ventilation proved impractical for large boiler fed pump service, we reversed the air flow to expel the warm ventilating air high over the pump. This prevents recirculation of discharge air . . . permits close parallel spacing of motors . . . greatly improves personnel comfort.

In addition to ventilation changes, this modern cubical boiler feed pump motor incorporates the latest advances in bearings, insulation, rotor, and stator design. It's built to serve you with the year 'round reliability the vital power industry requires.

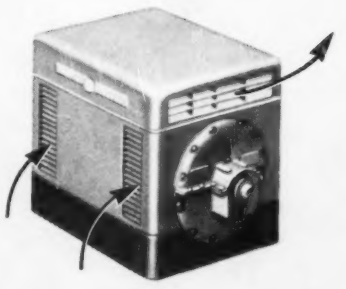
Some of the features of the G-E drip-proof Boiler Feed Pump Motor which make it a true power station motor from top to bottom are:

STREAMLINED ROTOR construction prevents "siren" effect—built-in deflectors and large discharge chamber cut overall noise level considerably.

DUAL LUBRICATION SYSTEM combines the advantages of force-flood lubrication and self-lubricated oil rings . . . gives extra protection . . . assures long, reliable bearing life.

COMPLETE 360 DEGREE ENDSHIELD supports bearing from top as well as bottom . . . assures continuous, accurate bearing lineup. Both endshield halves are sturdy ribbed castings.

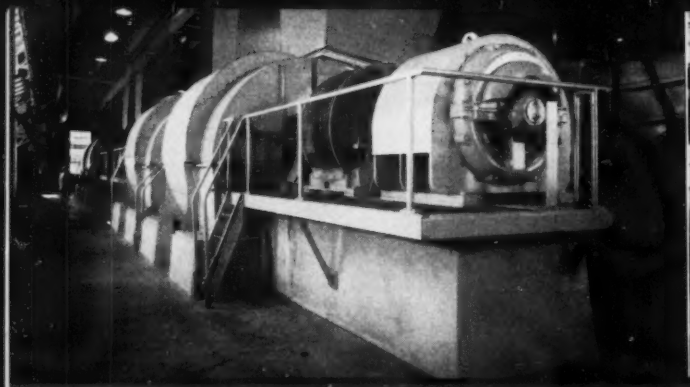
For more information contact your nearest G.E. Apparatus Sales Office or write for Bulletin GEA-5813 to General Electric Co., Section 753-3, Schenectady 5, N. Y.



Conventional motor (top) expels heated discharge air into the aisle—G-E Boiler Feed Pump motor exhausts air high over the pump.

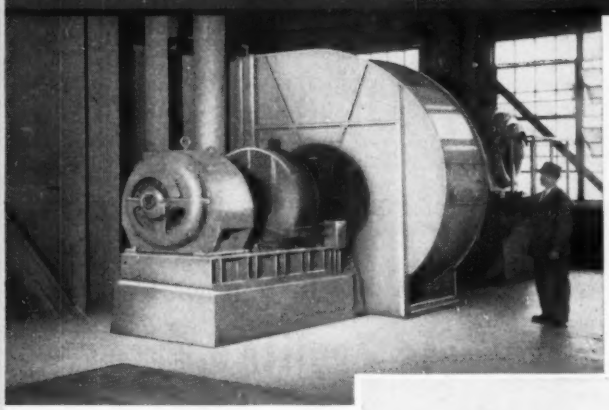
You can put your confidence in—

GENERAL ELECTRIC



"Buffalo" INDUCED DRAFT FANS are known for their ability to stand punishment and to deliver efficiently.

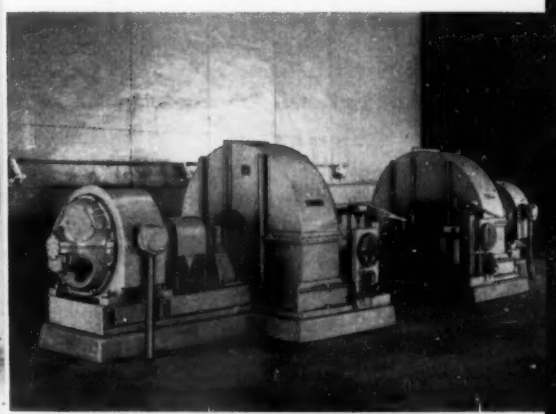
You'll Make the BEST CHOICE of DRAFT FANS from this COMPLETE LINE!



You can pick the best possible draft fan for the particular job because "Buffalo", pioneer manufacturer in the field, has developed a special fan for each job. Besides the fans illustrated here, "Buffalo" builds Sintering Fans; high-pressure Scavenging Blowers for Diesel-electric power plants; Over-fire blowers; and Industrial Exhausters for smaller induced draft installations. Why not investigate the construction and performance details that make "Buffalo" Fans the first choice for many of the country's leading power stations and plants? Write for Bulletin 3750 today, and look over this COMPLETE choice!

"Buffalo" FORCED DRAFT FANS give stable performance even when fuel bed is unusually heavy.

"Buffalo" COMBINATION DRAFT FANS are compact forced and induced draft fans with a common rotor shaft.



"Buffalo" PRIMARY AIR FANS blast pulverized coal and hot air into combustion chambers without letup.

DIAMOND JUBILEE 75TH ANNIVERSARY

FIRST FOR FANS

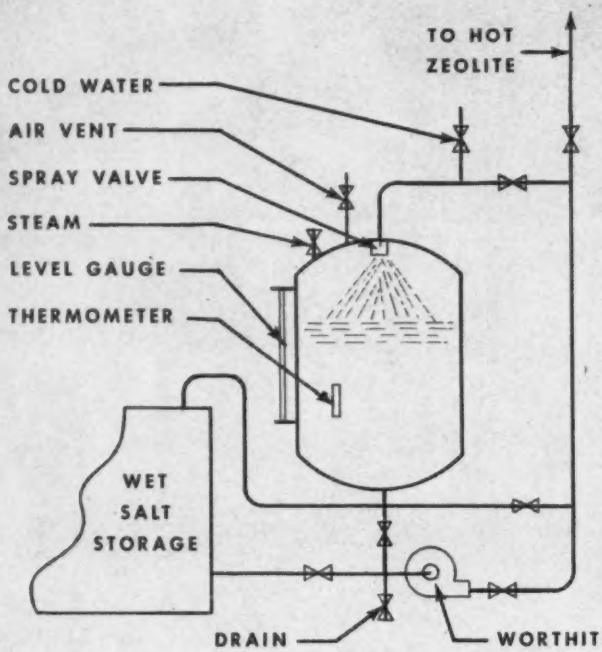
BUFFALO "Buffalo" FORGE COMPANY

488 BROADWAY BUFFALO, NEW YORK

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

VENTILATING | PRESSURE BLOWING AIR CLEANING | COOLING AIR TEMPERING | HEATING INDUCED DRAFT | FORCED DRAFT EXHAUSTING



SEQUENCE OF OPERATION OF WORTHINGTON'S HOT-Z REGENERATING SYSTEM*

1. To initiate service, gradually raise zeolite to operating temperature by regulating steam supply to injection water.
2. Return excess water to wet salt storage or discharge through drain.
3. Fill heater storage with saturated brine to desired level.
4. Recirculate until operating temperature is reached.
5. Deliver measured, heated and deaerated brine to zeolite.
6. Return excess brine to wet storage for resaturation.
7. To cut zeolite out of service, inject fully heated water and gradually reduce temperature by regulating steam supply.

*patent applied for.

MAXIMUM LIFE FROM ZEOLITE

How Worthington's Hot-Z Plant protects Zeolite by maintaining uniform temperature during regeneration

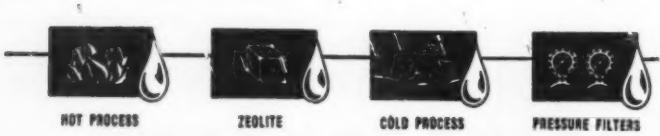
Another feature to check into when you're choosing Hot-Z treating equipment: *the regenerating system.*

For maximum life of the zeolite, two requirements should be met. 1. *A uniform temperature* should be maintained while regenerating the zeolite: that is, the regenerant solution should be held at essentially the same temperature as the water under treatment. 2. When putting a softener into or out of service, the temperature of the zeolite should be raised or lowered *gradually.*

Worthington has accomplished this dual objective with a brine deaerating heater for regenerating the hot zeolite. Its operation is explained in the diagram and accompanying caption. Deaeration is desirable to retard corrosion which might be caused by oxygen in the brine.

This heating system is just one of several exclusive features you'll find in every Worthington Hot-Z system. Remember, too, that Worthington makes all of the major types of water conditioning systems. Let us study your problem and recommend the most suitable solution. Write, stating service conditions in detail, to Worthington Corporation, Water Treating Division, Harrison, N. J.

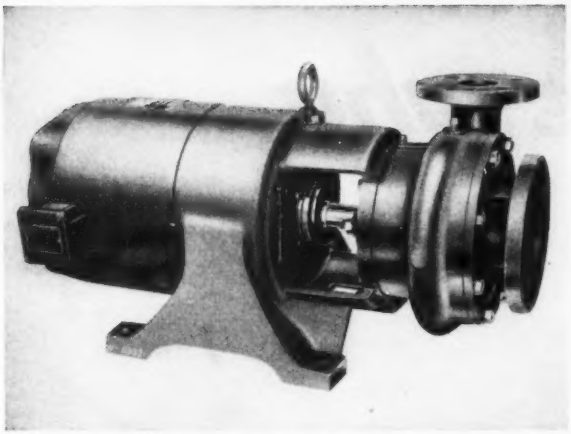
J.2.3



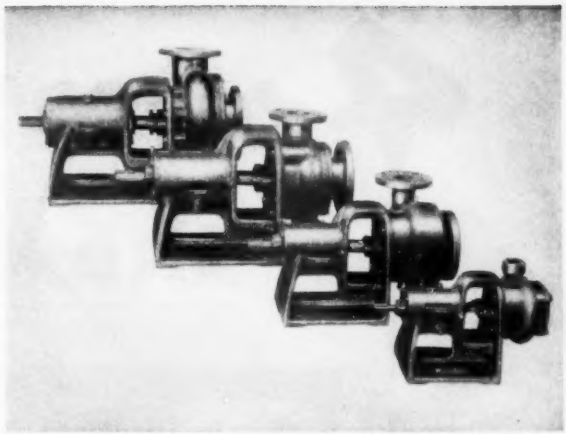
Worthington Makes More of the Equipment for ALL Types of Water Conditioning Systems

WORTHINGTON

Water Conditioning

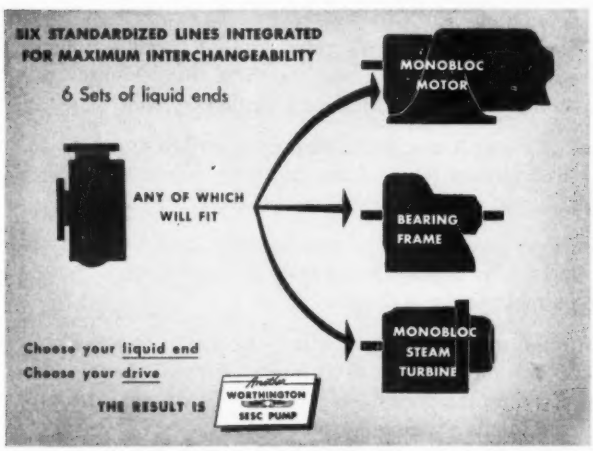


WITH BUILT-IN MOTOR—Well known throughout industry is this compact streamlined Worthington Monobloc centrifugal pump. Worthington SESC standardization makes it possible to interchange any of six sets of liquid ends to the motor housing.



FOR ANY CONVENIENT DRIVE—Frame-mounted units are available in four frame sizes. Like the Monoblocs, they use the same six sets of liquid ends and either conventional packing or a standardized mechanical seal that is readily changed in the field if necessary.

Why Worthington's SESC* pump line means greater availability, broader selection, easier servicing



STANDARDIZATION of *parts*, *mountings*, *materials* and *dimensions* virtually eliminates the necessity of slow and expensive custom manufacture to meet special pumping requirements. From 650 parts within its six standardized sets of liquid ends, Worthington can assemble 60,000 *different* standard pumps! C.3.1

Greater availability because the new Worthington pump line will handle more requirements with a *standard*, readily obtainable unit.

Broader selection because of the complete range of ratings and special design features in the 60,000 different SESC pumps.

Easier servicing because standardized parts mean lower parts-inventory requirements.

This sums up the advantages you can expect when you use Worthington standardized centrifugal pumps. The SESC line is Worthington's latest move towards assuring you the *right* pump for the job.

For more information, contact your local Worthington distributor or write for Bulletin W300 B-4 to Worthington Corporation, Centrifugal Pump Division, Harrison, New Jersey.

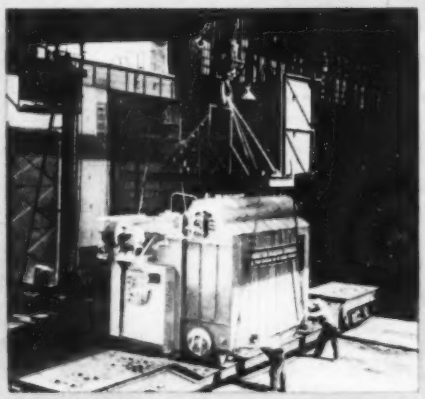
**Standardized End Suction Centrifugal*

The World's Broadest Line Assures You The Right Pump For Every Job

WORTHINGTON

Centrifugal Pumps

4 reasons why... the VP Package



1 Fully Water-Cooled Furnace – More cooling area per cubic foot of furnace volume than any other boiler of the VP's size and type. In all but the three smallest sizes, the VP Boiler has water-cooled walls on *all six sides* – including the burner wall.

2 Larger Lower Drum – The 30 in. diameter lower drum permits a simple, symmetrical tube arrangement . . . provides easy access for washing down or inspection . . . its greater water storage capacity facilitates the handling of fluctuating loads.

3 Centrifugal Fan – This more efficient type of fan operates at lower speed than other types and is quiet in operation. In fact, its average noise level is less than half that of typical high-speed blowers used on most package boilers.

4 Simple Baffle Arrangement – Minimum changes in direction – no baffle at all in convection bank in larger VP Boilers. This means lower draft loss . . . simplified soot blowing . . . elimination of dead pockets, thus, maximum heat pick-up. In the intermediate sizes, a water-cooled baffle assures minimum maintenance.

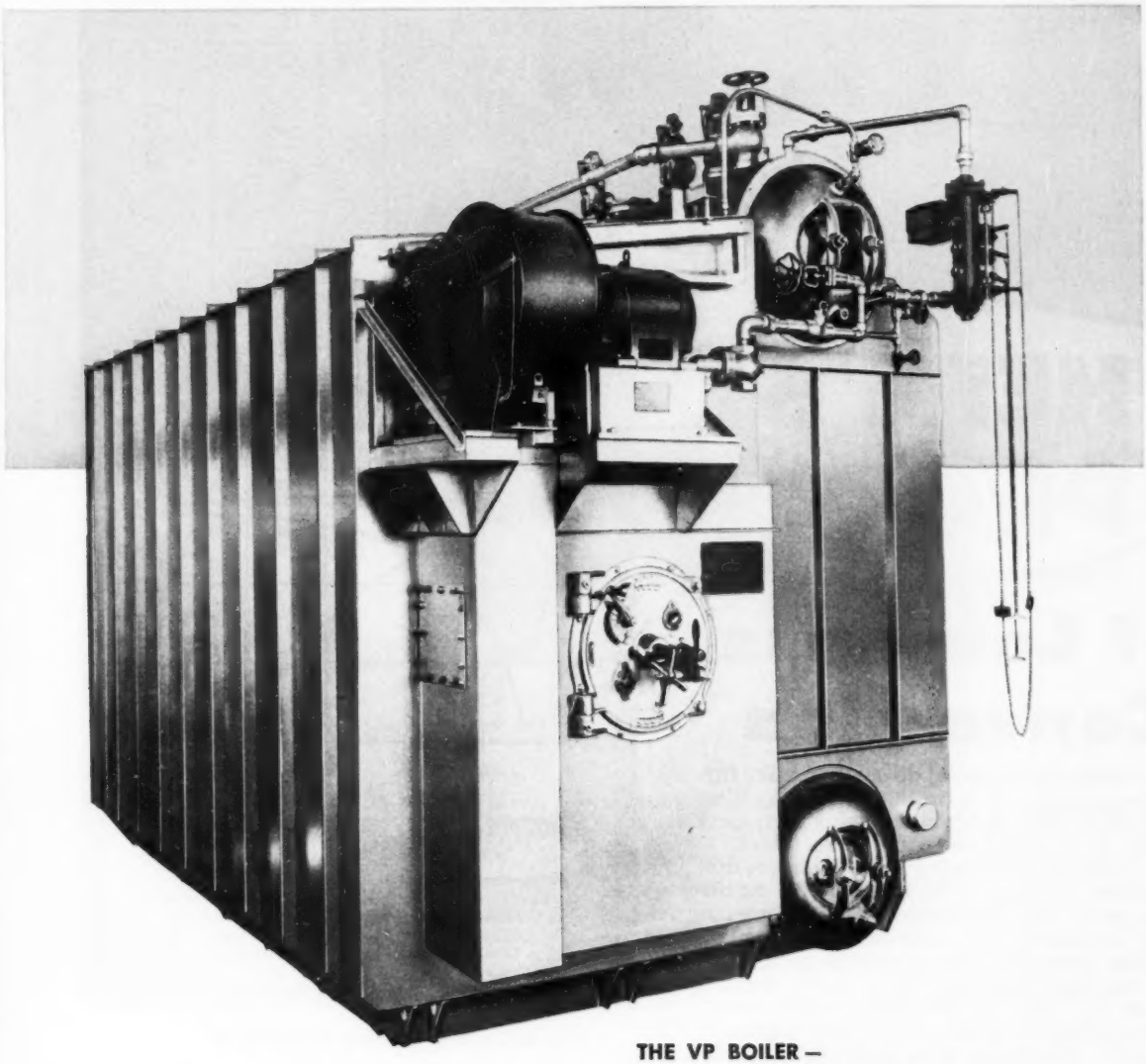
• • •

These four *extra* features are yours *only* in the VP Boiler which is designed and manufactured by Combustion – maker of many of the world's largest boilers. These units are available in capacities ranging from 4,000 to 30,000 lb of steam per hr, and pressures up to 250 psi.

Complete details on the C-E Package Boiler, Type VP, are available to you. Send for your free copy of Bulletin VP-101.

COMBUSTION

is Your Best Boiler Buy



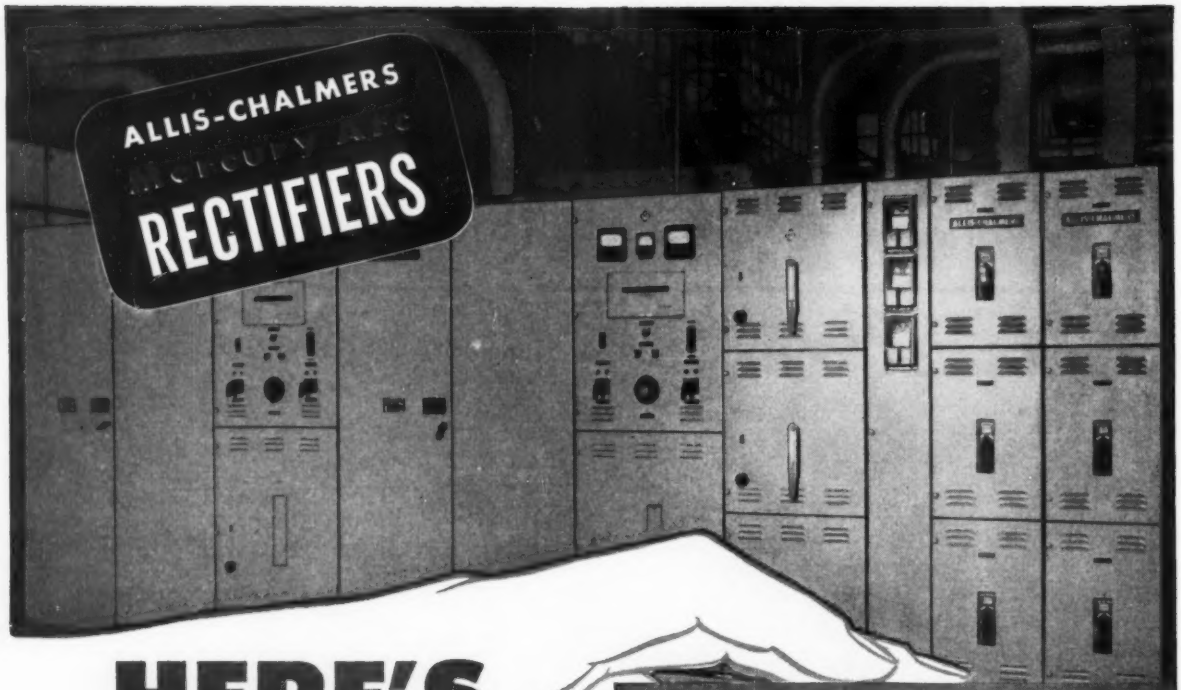
THE VP BOILER—
the Package Boiler with *extra* features.

B-666

ENGINEERING, INC.

200 MADISON AVENUE, NEW YORK 16, N. Y.

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

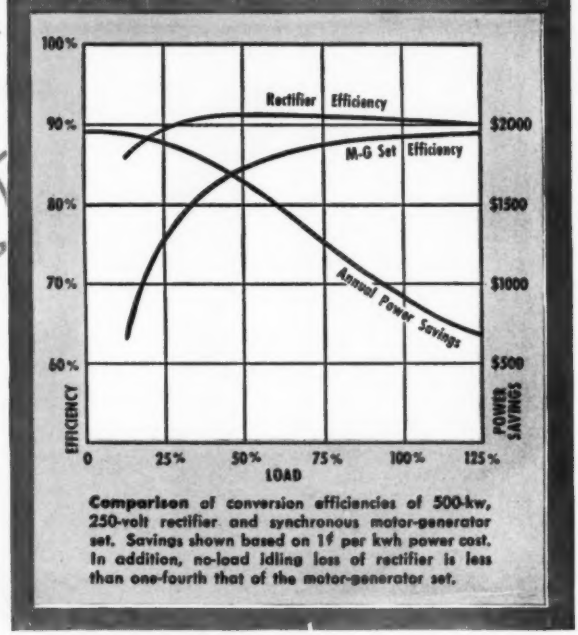


HERE'S PROOF of Low-Loss Conversion

TO OBTAIN economical dc power for arc furnace and blooming mill auxiliaries, West Virginia Steel & Manufacturing Company recently installed mercury arc rectifiers.

The factory-packaged Allis-Chalmers unit includes duplicate 500-kw, 250-volt rectifiers, with tube, breaker, control, and metering compartments, plus dc and ac plant feeder breakers. Since transformers could be installed outdoors, the assembly departs from the usual double-ended arrangement.

Rectifiers were chosen for their high conversion efficiencies *plus* simplified foundation needs, easy installation and minimum maintenance. And Allis-Chalmers units incorporate continuous excitation, grid phase control, internal cooling and enameled anode seals.



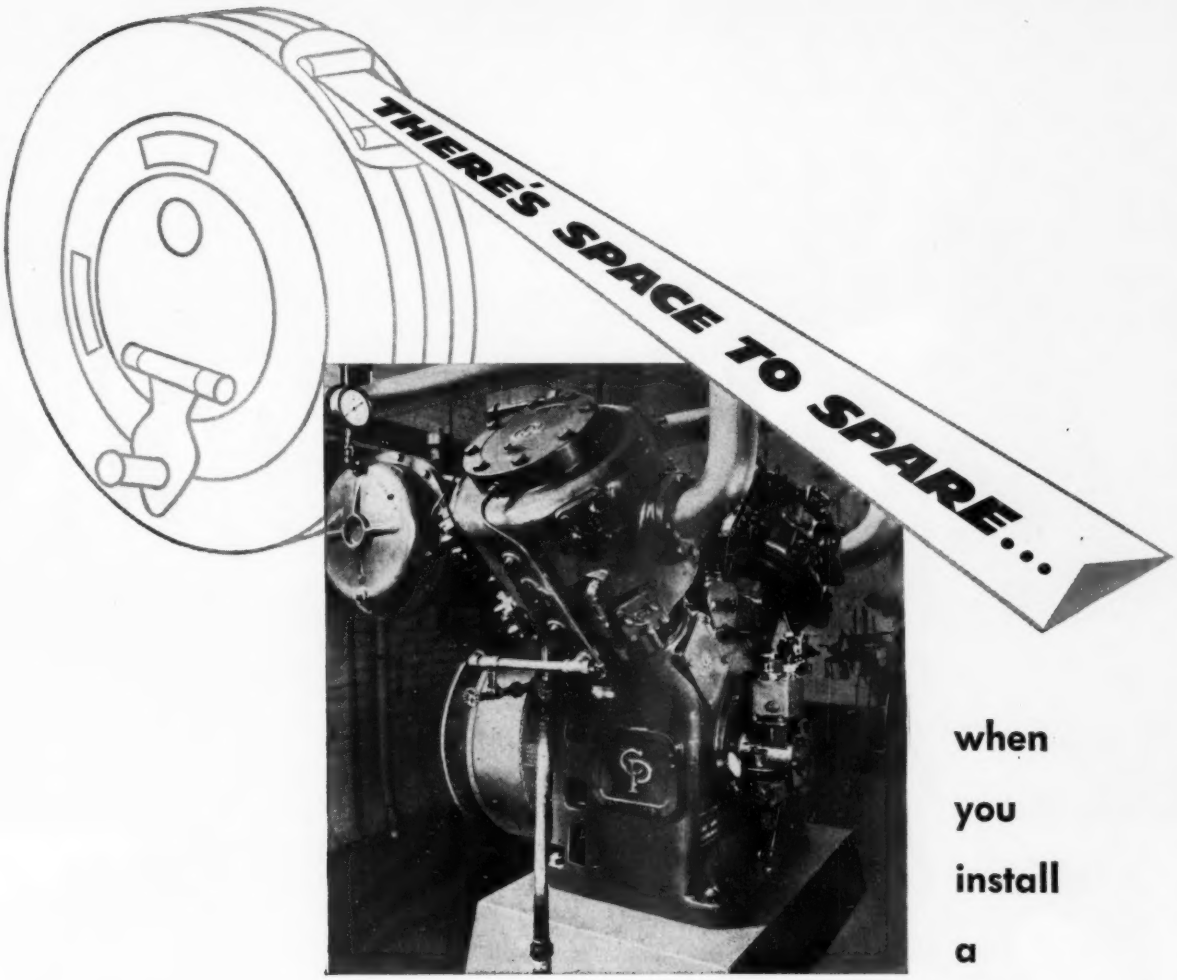
Comparison of conversion efficiencies of 500-kw, 250-volt rectifier and synchronous motor-generator set. Savings shown based on 1¢ per kwh power cost. In addition, no-load idling loss of rectifier is less than one-fourth that of the motor-generator set.

Use A-C's Engineering Experience

By calling your A-C representative, you can put A-C's quarter century of rectifier application experience to work on your power conversion problems. Allis-Chalmers, Milwaukee 1, Wisconsin. A-3989

ALLIS-CHALMERS

Our Engineers Introduced Mercury Arc Rectifiers to U. S. Industry



when you install a

TYPE Y....

compressor

Where space is limited, industry relies more and more on Chicago Pneumatic's compact, heavy-duty Type Y Compressor. It takes up minimum floor area, yet is ideal for long, continuous heavy duty. Shipped as a complete "package" ready for easy installation, it requires the simplest of foundations—needs no alignment.

The highly efficient Type Y Compressor has roller main bearings, precision connecting rod bearings, multi-step capacity regulation, and an easy-to-clean shell-and-tube intercooler.

Available in sizes from 75 hp to 250 hp, 410 cfm. to 1663 cfm., and with flange mounted, belted and coupled motors. Write for Bulletin 766. *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.*

Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

—and now TAPER-LOCK

There's only ***ONE*** **TAPER-LOCK**

FROM the package to the shaft — ready, *immediately,* for the job! This is the new "off-the-shelf" availability which Dodge brings to roller chain drives. And, with this new availability, you get the important advantages of the famous Taper-Lock principle, proved in millions of V-belt installations.

No more costly and time-consuming boring of sprockets to fit your shafts! *Taper-Lock bushings are available in a range of sizes for the great majority of industrial applications.* And it's not necessary that shafts be turned and ground to get a tight fit. *Taper-Lock not only is keyed to the shaft, but grips it with the firmness of a shrunk-on fit.* Yet when a sprocket is to be replaced, it comes off easily, quickly. The bushing may be re-used.

Taper-Lock sprockets are compact. They have no flange, and no protruding parts. Taper-Lock occupies no more space on the shaft than standard sprockets. The flush design means safety.

The new Dodge line of roller chain is made to highest quality standards, by craftsmen who know chain manufacture. Both chain and sprockets are made to ASA standards. Taper-Lock sprockets will take any make of American standard chain.

Taper-Lock sprockets will be carried in Distributors' stocks for immediate delivery, in a complete range of B-type steel sprockets—½" to 1¼" pitch. The range in ⅜" pitch, for example, is 12 to 112 teeth.

All bushings and the smaller sizes of sprockets are packaged individually. Dodge roller chain is packaged in 10-foot lengths — and can be furnished in 50-foot and 100-foot reels.

For detailed information about Taper-Lock sprockets and Dodge chain drives write now for Bulletin A-624.

DODGE MANUFACTURING CORPORATION, 3200 Union St., Mishawaka, Indiana

SPROCKETS

-and DODGE ROLLER CHAIN

CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory-trained by Dodge, he can give you news of cost-saving methods. Look for his name under "Power Transmission Equipment" in your classified phone book.

DODGE

of Mishawaka, Ind.

ECONOMICAL answers to industrial problems—a few of which are shown on these pages—call for specialized *facilities* and years of *experience*.

Here at Alco you will find a large measure of both. You will find experience gained through many years of designing and fabricating heavy metal equipment for petroleum, chemical, power and manufacturing companies all over the world.

You will find modern equipment and machines, many of them designed and built by Alco, capable of meeting almost every conceivable type of metal-fabricating requirement—facilities operated by skilled craftsmen, and applied by designers and engineers fully aware of industry's needs.

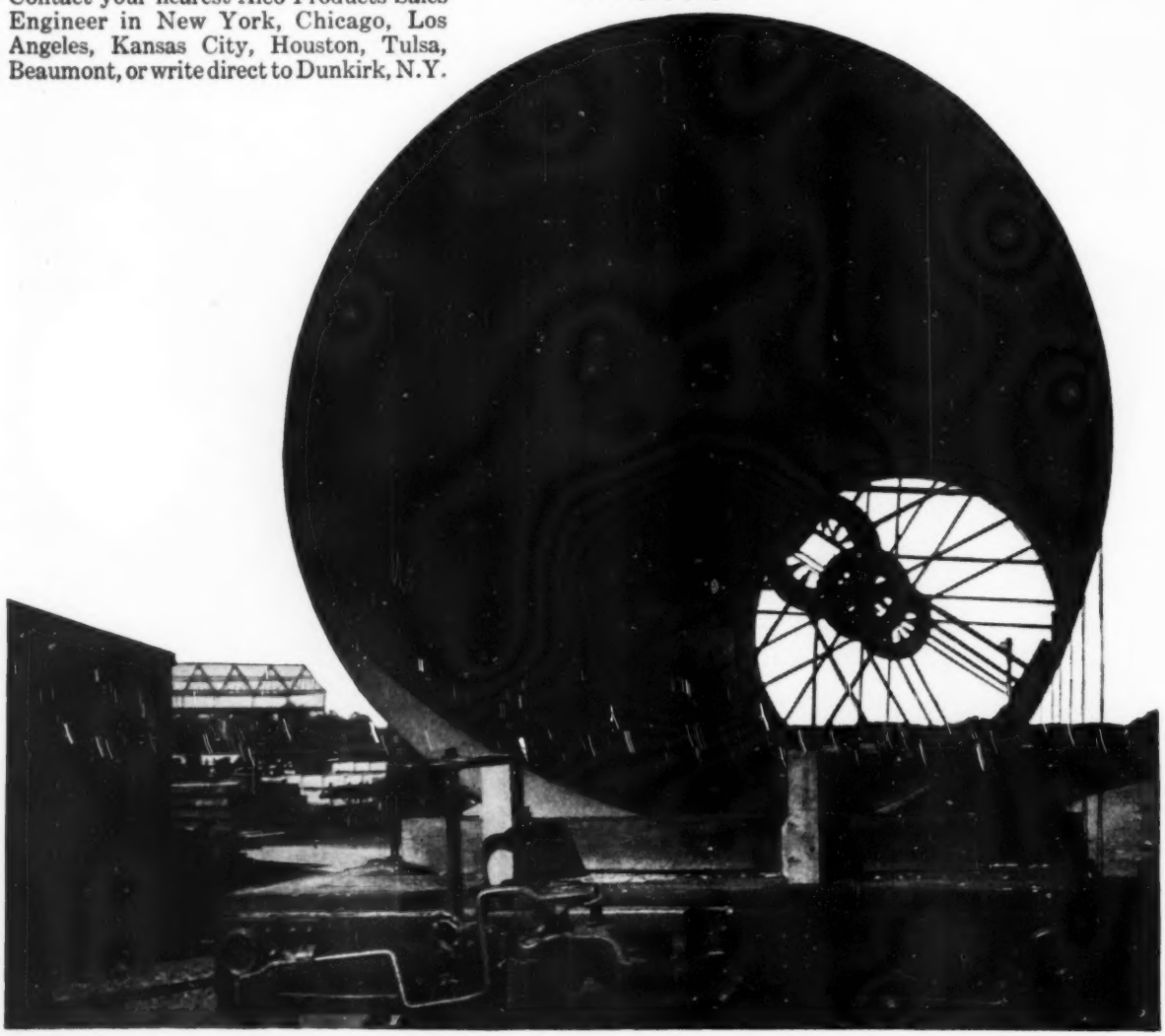
If you have a difficult metal-fabricating problem—a problem that challenges the imagination, that points to new equipment or offers new opportunities to cut production costs—we invite you to let Alco's facilities and experience produce the answer.

Contact your nearest Alco Products Sales Engineer in New York, Chicago, Los Angeles, Kansas City, Houston, Tulsa, Beaumont, or write direct to Dunkirk, N.Y.

ALCO facilities

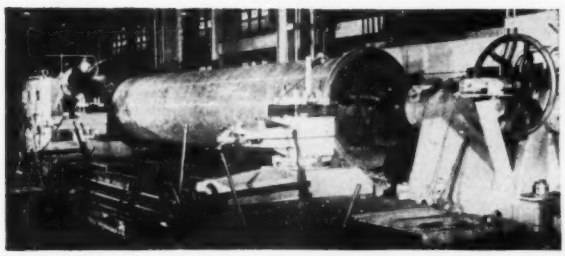
Answers to

TUNNEL INTERLININGS furnished by Alco in cold-rolled, carbon-silicon steel sections 40 ft long and 10 ft 6 in. in diameter will reinforce the outlet end of New York City's new $44,000,000 deep-rock East Delaware Water Supply Tunnel. Held to close dimensional limits, electric fusion welded throughout, they are the latest of many special piping sections fabricated over the years by Alco for New York water supply projects.

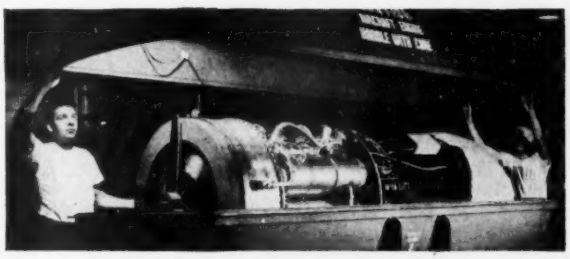


and experience produce...

New Industrial Problems



GIANT LATHE at Alco's 31-acre Dunkirk plant finishes and faces both flanges simultaneously on steel pipe up to 41 in. in diameter! Special machines like this, many of them Alco designed and all guided by the skilled hands of veteran craftsmen, help Alco solve the toughest of metal-fabricating problems.

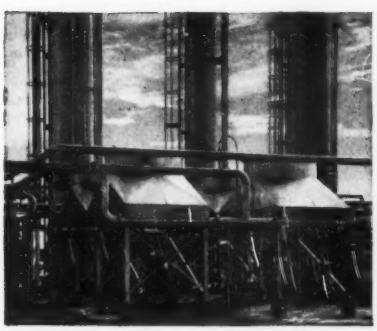


STEEL "CANS" FOR JET ENGINES, mass-produced by Alco, are carefully engineered to meet strict Air Force specifications. Example: they must "provide a barrier against the entry of water, dust, air and moisture *without* the aid of separately applied sealing compounds or materials."

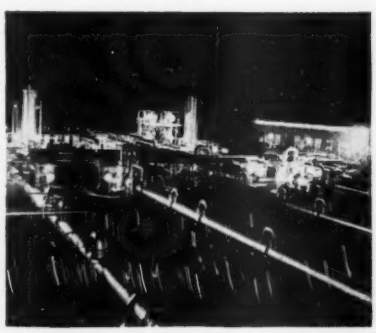
ALCO

ALCO PRODUCTS DIVISION

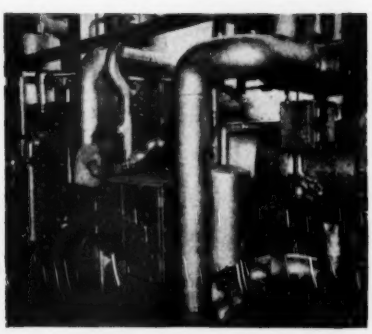
AMERICAN LOCOMOTIVE COMPANY • DUNKIRK, NEW YORK



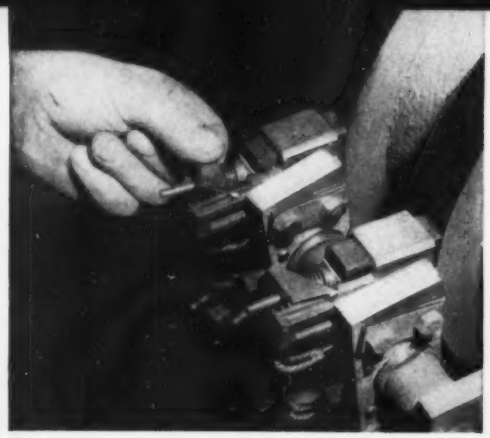
"UNI-BUNDLE UNITS," with their specially fabricated steel headers, demonstrate the versatility of Alco Aircoolers. Vertical partitions welded in the headers allow several different vapor or liquid streams to be handled in a single tube-bundle. Here, for example, at a large Southwestern natural gasoline plant, the Alco Aircooler at right not only cools the oil but also condenses the overhead vapor from the stream.



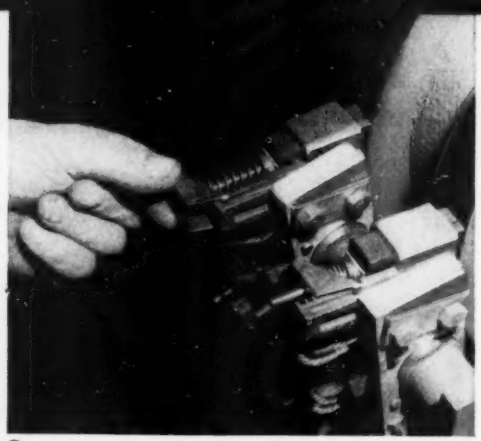
"TRAIN" HEAT EXCHANGERS, designed and built of nickel steel by Alco for the Tennessee Gas Transmission Company's new gas processing plant (the world's largest) at Gabe, Kentucky, helped cut both installation and operating costs. Their flange-to-flange construction minimized the amount of connecting piping required, while their huge size (42 in. in diameter, 150 ft long) assured maximum processing efficiency.



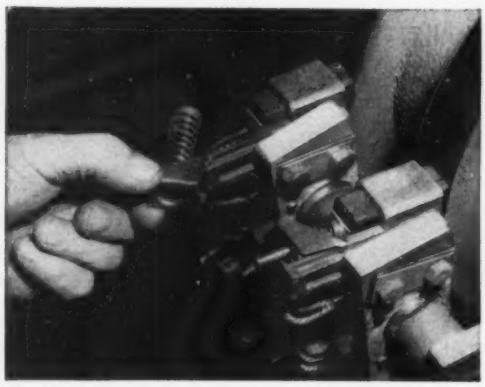
SPECIAL ALCO FLEX-TUBE EVAPORATORS at the Carolina Power and Light Company's new 150,000-kw plant at Goldsboro, N. C., produce vapor containing not more than 0.5 parts per million of mineral solids, hold make-up to less than one-half of one per cent. With its patented Flex-Tube construction, this Alco evaporator offers industry a positive-acting thermo-mechanical descaling device for straight-tube installation.



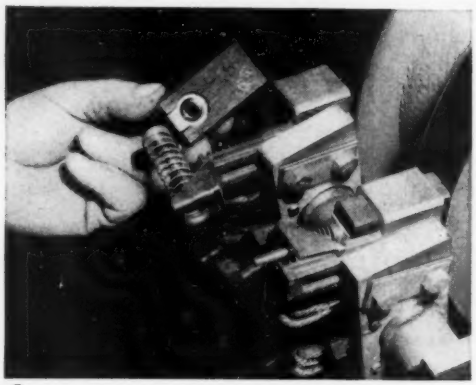
1 To reset brush tension, operator releases spring lock . . .



2 slides it back to relieve pressure . . .



3 and swings locking device to one side . . .

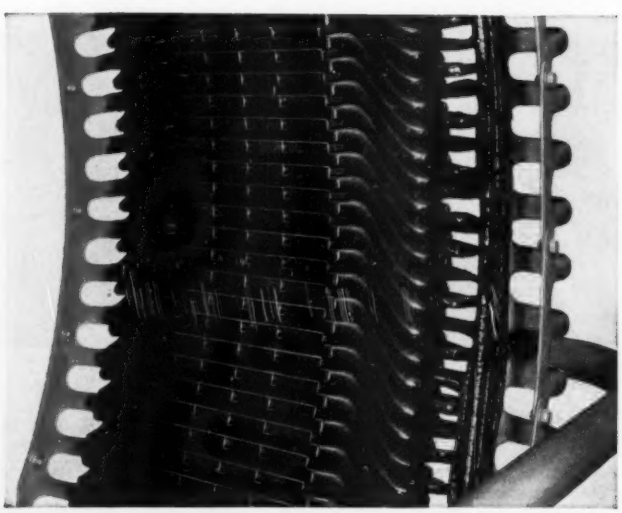


4 for fast and easy brush removal.

BRUSH-PRESSURE ADJUSTMENT, for maximum brush life, and replacement, to assure reliable motor service, are simple matters on G-E synchronous motors. A calibrated spring-loaded brush holder makes resetting brush tension or removal of brushes fast and easy. Brushes are staggered for even brush-ring wear.

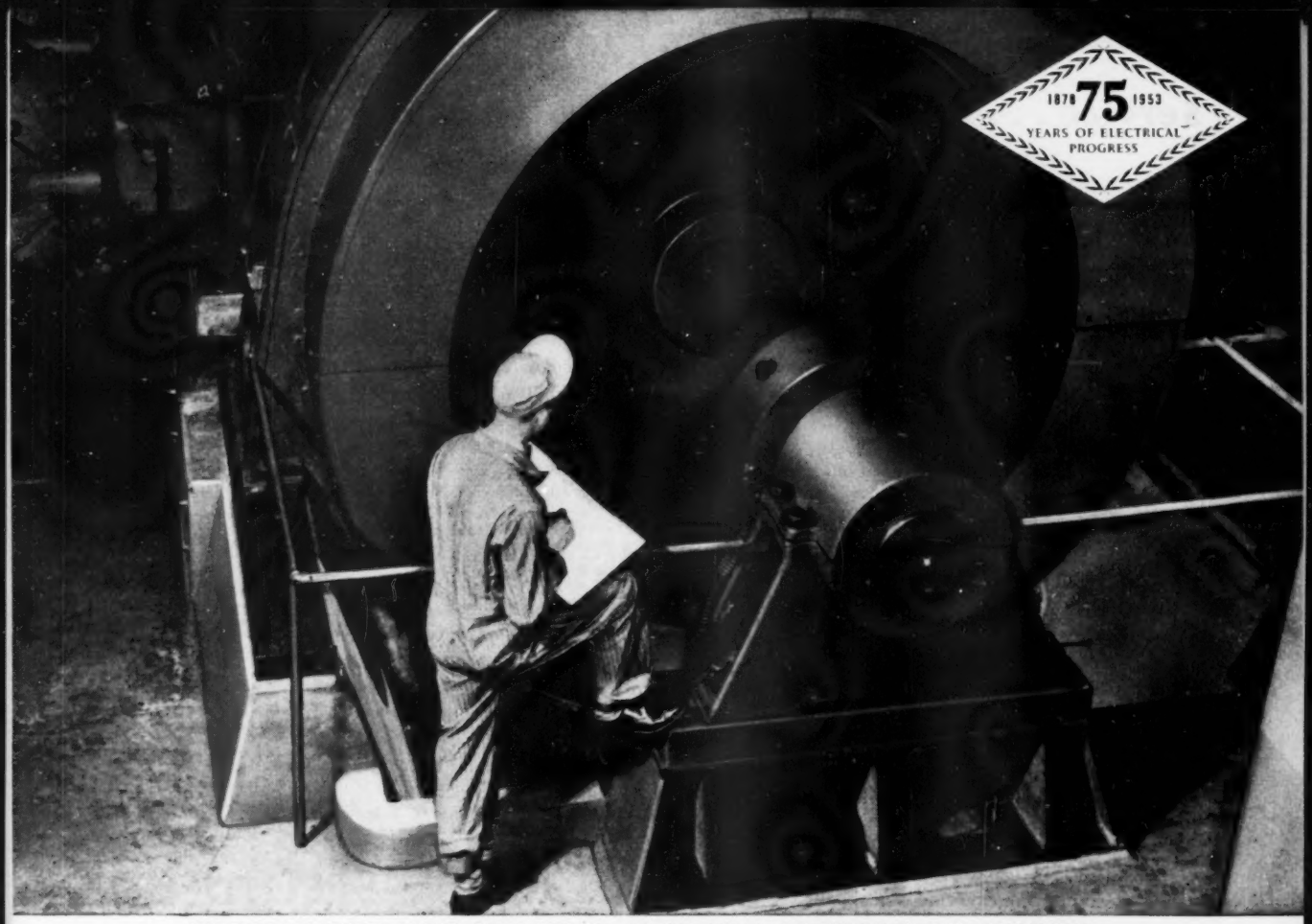
See How Routine Maintenance Is

BEARING LUBRICATION can be readily checked through a large sight-level gage on the bearing pedestal; and when oil is required, handy snap-top covers are provided for easy refilling, as well as oil-ring inspection. A drain plug is conveniently located for quick oil changes.



INSULATION CLEANING is fast on G-E synchronous motors. Windings are coated with a high-gloss Glyptal* varnish that resists the accumulation of dust and can be vacuum or air cleaned in most applications. In extremely dusty or oily atmospheres, deposits can be easily wiped from the windings. Clean windings mean longer insulation and machine life.

*Reg. trademark of General Electric Co.



THIS G-E SYNCHRONOUS MOTOR, RATED 4500 HP, 300 RPM, DRIVES A RECIPROCATING GAS COMPRESSOR.

Easier on G-E Synchronous Motors!

Routine maintenance involves three factors: brushes, lubrication, and insulation. To be sure that these areas are properly serviced, G-E synchronous motors have design features that make checking easy and maintenance fast. Close at hand and easy to adjust, the brush-rigging construction encourages your maintenance men to inspect regularly. Oil-level gage and inspection caps are arranged for quick checking and filling when necessary. The high-gloss insulation on G-E synchronous motor windings resists the adhesion of dust and minimizes the need for cleaning.

These features promote long, reliable motor service and save valuable time for your maintenance crews.

Before selecting your next heavy-duty motor, be sure to consider these important maintenance features. Call in your G-E representative. He will be glad to discuss the many money-saving applications for G-E synchronous motors. Meanwhile, you can obtain more information on G-E synchronous motors by requesting the following publications: GEA-5332, "Low-speed Synchronous Motors" or GEA-5426, "High-speed Synchronous Motors." Write to Section 770-28, General Electric Company, Schenectady 5, N. Y.

You can put your confidence in—

GENERAL ELECTRIC

Service . . . *where and when you want it*

PROMPT, experienced service is one of the most important plus values you get when you buy Honeywell instruments. An unequalled organization of trained specialists is always at your call at more than 110 offices in the United States and Canada. Offices are located in practically every large industrial city of the country . . . close to every major production center.

Trained Personnel

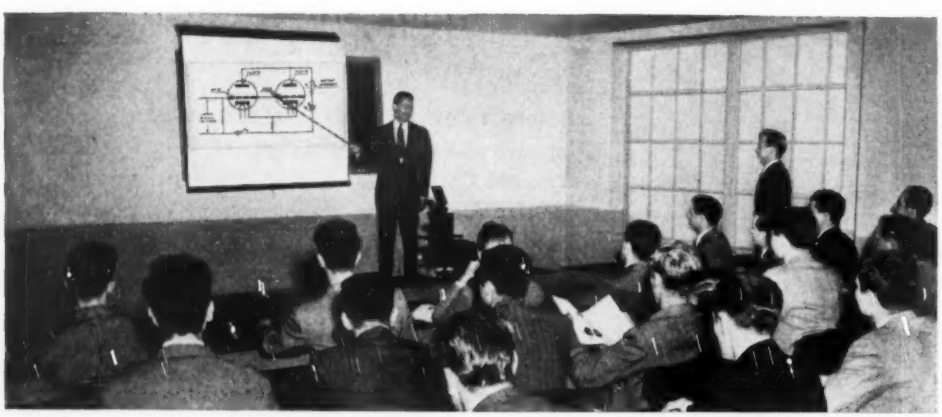
Honeywell service men are schooled not only in the theory of measurement and control, but also in the practical art of keeping good instruments in the best condition. Hand picked men begin this instrument education in an intensive training program in Honeywell factories. After graduation, they serve an apprenticeship in the field offices . . . while they learn still more about instrument maintenance from first-hand contact with plant problems. By the time a Honeywell man arrives at your plant on a call, he's a finished product worthy of the responsibility he bears, and capable of doing the kind of service job that you need . . . and that your Honeywell instruments deserve.

When trouble strikes, a wire or telephone call will bring a service man to your plant . . . often within a few hours. This assurance of prompt action means a lot to your production schedules. You'll never be left out on a limb because of delays in instrument maintenance.

Periodic Service Plan

But why wait for emergencies? Preventive medicine works on instruments, too. And the prescription is simple . . . a Periodic Service Contract, which brings a Honeywell service man to your plant at regular intervals to inspect, clean and adjust any Honeywell instruments you have. The plan is economical . . . can save you many hours of lost production time. Your nearest Honeywell office will be glad to give you full details.

A faster, stronger *for steam*



TRAINED TO SERVE: *In Honeywell's service school, students get a thorough grounding in instrument theory and practice. After graduation, they become part of the most extensive organization of its kind in the world . . . ready to serve you competently and promptly, whenever and wherever you need them.*

FOR getting high-speed, precise measurements of steam temperatures, the Brown butt-welded thermocouple is the ideal partner for *ElectroniK* instruments. This thermocouple's unique characteristics come from an entirely new kind of design, in which the two couple wires are electrically welded together in a butt joint.

The thermocouple is *faster*—because the mass of the junction is much smaller than the usual twisted joint. It's *stronger*—withstands vibration and shock better. And it's *more accurate*—because the loop formed at the joint prevents heat conduction from the junction back to the insulators.

A wide line of thermocouple wells is supplied for various steam plant applications . . . including a series especially designed for high pressure steam lines. All Brown thermocouple wells are precision-machined to highly uniform wall thickness, to guarantee dependability at high temperatures and pressures. They are available in a broad choice of standard sizes and designs, supplemented by special types made to individual specifications.

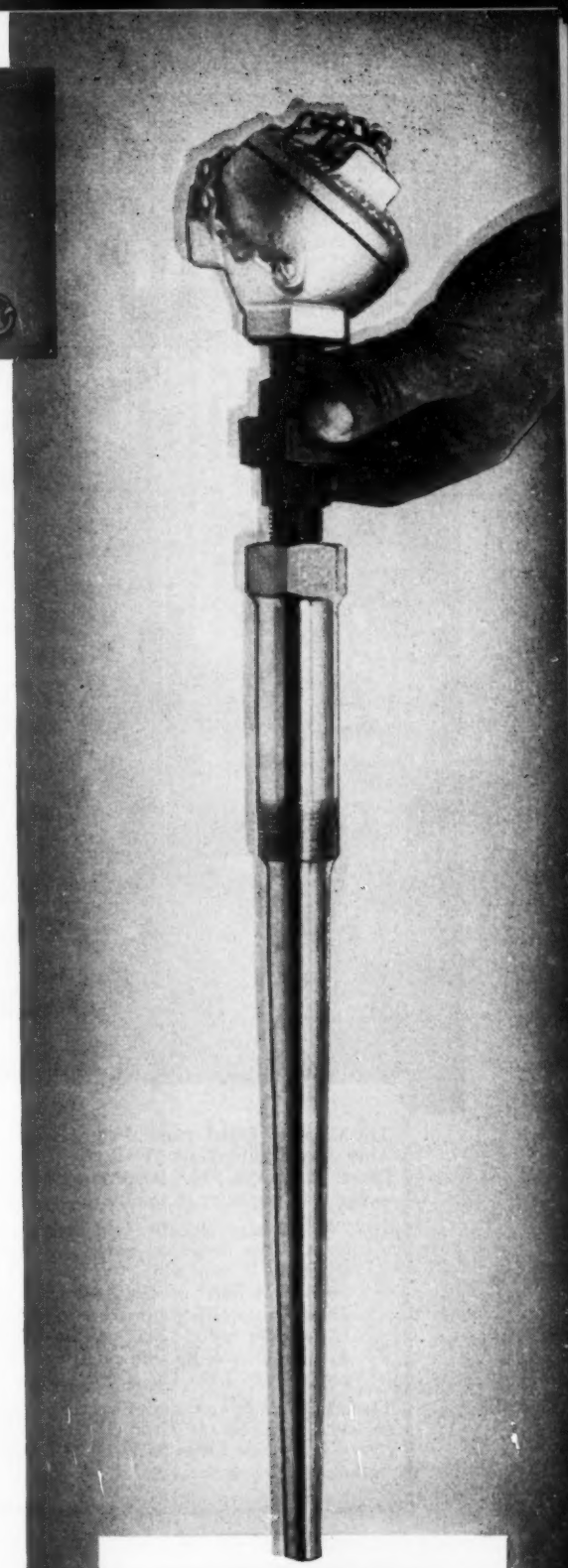
thermocouple *plant temperatures*

For specifying and purchasing all instrument supplies and accessories, you'll find new convenience and economy in the Honeywell Supplies Man—HSM—Plan. Your local HSM will be glad to explain the plan in detail, and to show you how planned buying can save you time and trouble. Call him today . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4490 Wayne Ave., Philadelphia 44, Pa.

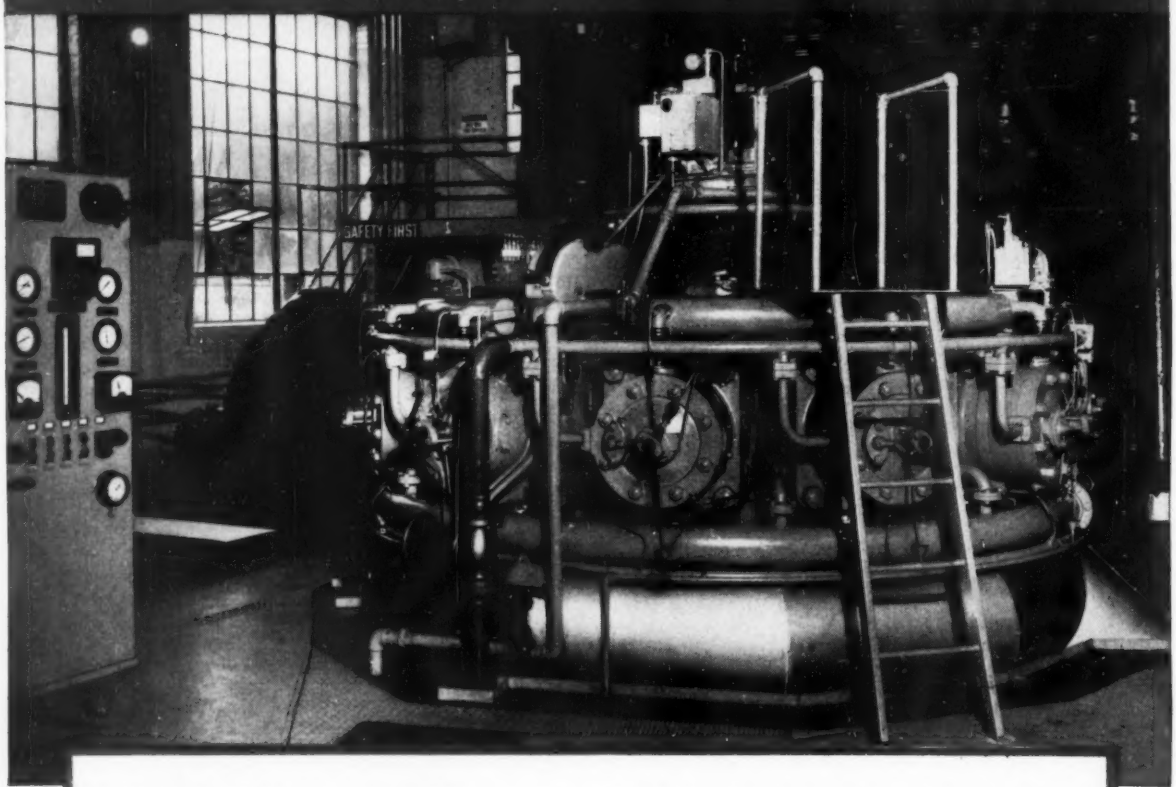
● **REFERENCE DATA: Write for Pyrometer Supplies Buyers' Guide No. 100-4 . . . and for Specification Sheet No. 200-2 on Thermocouple Wells.**

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls



STEAM THERMOCOUPLE *has tapered stainless steel well, precision-drilled to highly uniform wall thickness. Inset shows butt-welded thermocouple junction. The small mass gives fast response . . . curved wires prevent heat conduction away to the insulators.*

"...SO MUCH BETTER LUBRICATION WITH TEXACO URSA OIL"



The Marshall (Michigan) Water and Electric Company started using *Texaco Ursa Oil* in two 5-cylinder Diesel engines in 1947. Results were so satisfactory — but read the story in the user's own words.

> "We got so much better lubrication with *Texaco Ursa Oil* — lower maintenance costs and fuel economy — that when we installed a new 6-cylinder Diesel in 1948 we naturally chose *Texaco Ursa Oil* to lubricate it. Same with the 11-cylinder radial Diesel we installed in 1951. As new Diesels go into our plant, you can be sure *Texaco Ursa Oil* is going in with them."

The Marshall Water and Electric Company's experience with *Texaco Ursa Oil* is typical. *Texaco Ursa Oil* is made for lubrication of Diesel, gas and dual-fuel engines. It stands up under toughest operating conditions . . . keeps rings free for proper compression and combustion, lower fuel consumption and lower maintenance costs. That is why —

> *For over 15 years, more stationary Diesel h.p. in the U.S. has been lubricated with Texaco than with any other brand.*

There is a complete line of Texaco Ursa Oils, approved by leading engine builders. A Texaco Lubrication Engineer will gladly help you select the proper one for your operation. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO URSA OILS

FOR ALL DIESEL, GAS AND DUAL-FUEL ENGINES

TUNE IN: Tuesday nights on television—the TEXACO STAR THEATER starring MILTON BERLE. See newspaper for time and station.

A Favorable Slant on Atomic Power

DECEMBER 1952 POWER presented a keen economic analysis of atomic power by Philip Sporn, president of the American Gas and Electric Co. He concluded that truly commercial atomic power is many decades away. Our own editorial comment indicated our substantial agreement.

Here is the "other side," a summary of the paper Walker L Cisler, president of Detroit Edison, presented at a forum on "The Industrial Uses of Atomic Energy" on March 25 at the American Power Conference in Chicago. Nearly a thousand engineers gathered to hear Mr Cisler and other leaders in the atomic field. We judge this to be the most fruitful atomic forum yet held anywhere.

Many leading countries, Mr Cisler noted, have nearly exhausted their coal deposits and have developed their more economical hydro sites. Even in the United States, where coal reserves are immense, rising coal costs direct attention to the cheaper and more plentiful atomic fuels. From 1930 to 1952, while Detroit Edison's average revenue per kilowatt-hour fell 19 percent, its coal cost more than doubled. Cost of all conventional fuels will keep on rising, he predicted.

Assuming breeder plants that can completely consume uranium and thorium, the world's supply of fissionable materials (on a heat unit basis, and considering only recoverable deposits) is about 23 times the total supply of coal, petroleum and natural gas, Mr Cisler reported.

Also, because a single pound of uranium equals 1300 to 1500 tons of coal, costs of transporting the fissionable fuel to any part of the world will be negligible.

Mr Cisler indicated that a "nonregenerative reactor," which discards the U238 and uses only about half the U235 after a costly separation process, would make fuel costs too high (7 mills per kilowatt-hour) for ordinary commercial power plants, and would also be wasteful of natural resources.

A more practical possibility would be a "converter reactor" consuming about 1 percent of the natural uranium, with a fuel cost of about 1.3 mills, or less, per kilowatt-hour. With a true "fast breeder reactor," said Mr Cisler, fuel costs would drop to practically zero (0.013 mills per kilowatt-hour), assuming purified natural uranium at $35 per pound.

He analyzed atomic power from the angle of Detroit Edison's 625,000-kw St. Clair Station, now being built at an estimated cost of $158 per kilowatt. If the conventional boiler plant, costing $77 per kilowatt, were replaced by a nuclear-reactor steam generator, the extremely low cost of nuclear fuel would justify spending as much as $227 per kilowatt for steam-generating plant. To put this another way, a complete nuclear power plant costing $308 per kilowatt would break even with a coal-fired plant costing $158.

"At the present time," said Mr Cisler, "we do not know whether a breeder reactor can be built within the cost limits we have set. There are many technical problems to be solved, and it is impossible to make accurate cost estimates. It is our engineering judgment that this goal will be achieved.

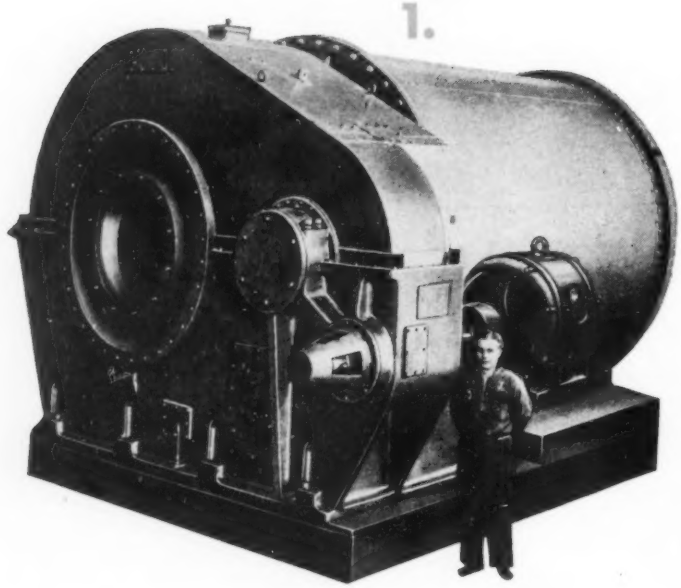
"From the standpoint of reactor design, construction and operation, the economic possibilities look bright indeed, but we still are in the development stage. We believe that the cost of reactors for the generation of electric power can be brought within reason and that an important new segment of industry may result. We believe, too, that there may be many auxiliary effects which will contribute greatly to the economy of our country."

Mr Cisler reminded his hearers that the present atomic-energy law forbids private atomic power. "Modification of the law is needed to permit the ownership of fissionable materials and facilities for using these materials under conditions compatible with national security."

The endless debate about when atomic power will be practical will never be resolved until competent elements of private industry are willing to build pioneer plants and are given the green light by government. It appears that Detroit Edison (associated in this venture with Dow Chemical Co) has the will to build. They should have their chance to make a vital contribution to the development of this great new art.

UNMATCHED ECONOMY with...

1.



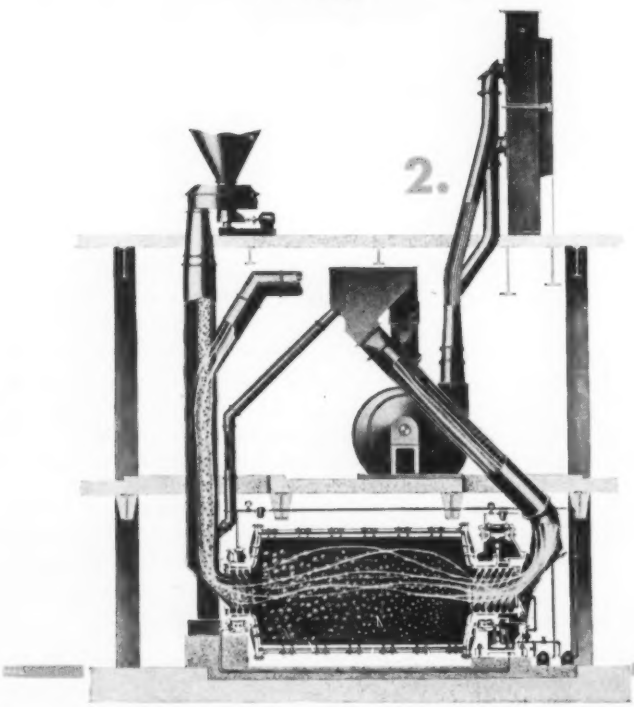
COAL PULVERIZED TO OBTAIN MAXIMUM HEAT VALUE

Through the unmatched economy of the KVS Coal Firing System, plants throughout the world are realizing tremendous savings in their fuel costs.

By pulverizing coal to a fineness of 85% to 90% through a U.S. standard 200 mesh screen, the KVS Coal Firing System obtains maximum heat value from every ton of coal burned. More heat means *more power* available from any given quantity of coal. No other system produces comparable results.

With the KVS system, coal firing is instantaneous, combustion complete. Unburnt carbon losses held to less than ½% *at all ratings.* Pulverized fuel instantly available to meet fluctuating loads with quick, flexible response to combustion controls. Free moisture is liberated in the mill while the coal is being pulverized.

2.



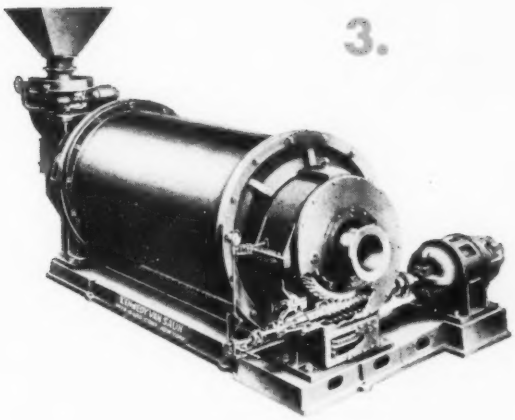
BURNS ANY GRADE OF COAL! ...CHEAPEST TO HIGHEST!

Because of the extremely fine pulverization obtained with the KVS Coal Firing System, the cheapest grades of coal provide complete combustion comparable to that obtained from more costly fuel. Tramp iron not only cannot damage the mill, but actually helps pulverization!

GET THE FULL FACTS ON THE KVS COAL FIRING SYSTEM!

Find out how you can cut coal costs by as much as a dollar a ton. Send for the facts today.

KENNEDY Pulverized Coal Firing System



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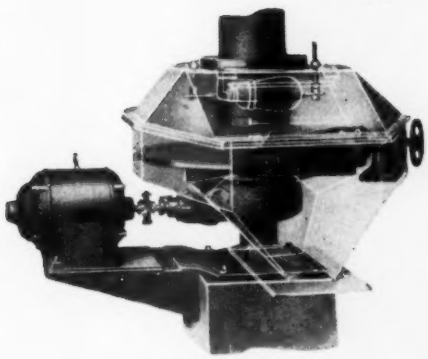


4.

1. AIR SWEPT TUBE MILL

Slow-speed ball mill for perfect pulverization by air separation. Low-cost grinding of all grades of coal regardless of hardness. Grinding balls can be added without shutting down. Continuous year-to-year operation with better than 99% availability. Complete designs for steam and coal installations.

2. COAL FIRING SYSTEM

Cutaway drawing of Kennedy Pulverized Coal Firing System showing disc feeder, pulverizer, classifier, exhauster, burner. Raw coal is delivered to disc feeder and fed into tube mill.

3. WORM GEAR TUBE MILL

The worm gear is desirable for medium and small size mills up to 66 inches in diameter and in various lengths. Worm shaft mounted in Timken roller bearings. Oil pump direct-connected to worm shaft. Complete designs for steam and coal installations.

4. DISC FEEDER

Variable speed disc feeder is driven by an electric motor. Completely enclosed to prevent coal dust from escaping into boiler room. Volumetric design prevents moisture content of coal from disturbing accuracy. Glass door and internal illumination permit easy visual inspection of moving coal. Disc cannot be broken by tramp iron or other foreign material.

HOW DO YOUR FUEL COSTS COMPARE?

- **What is your unburnt carbon loss?**
- **Do you pay premium prices for coal?**
- **What is your boiler efficiency at reduced rating?**
- **Do you lose coal when you change rating?**
- **How often do you shut down for repairs?**
- **Will tramp iron in coal damage your pulverizer?**
- **Can you afford frequent stoppages?**
- **What is the maintenance cost of your coal firing equipment?**

IT COSTS LESS.. TO OWN THE BEST!

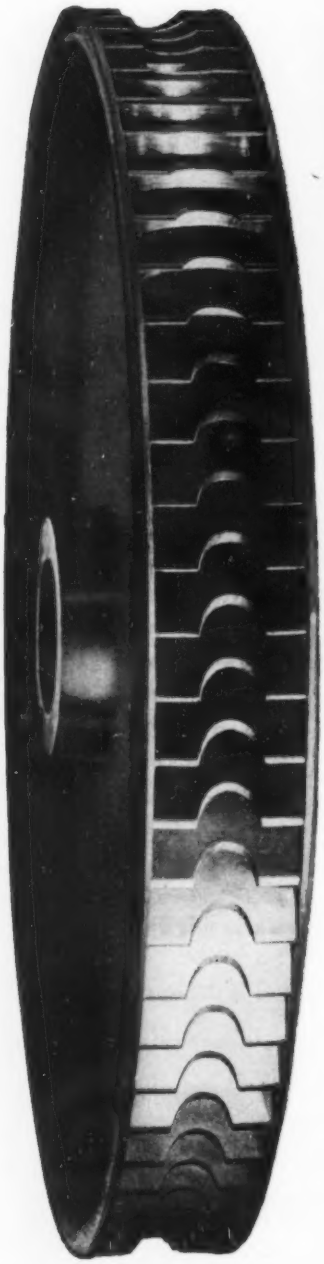
KENNEDY - VAN SAUN

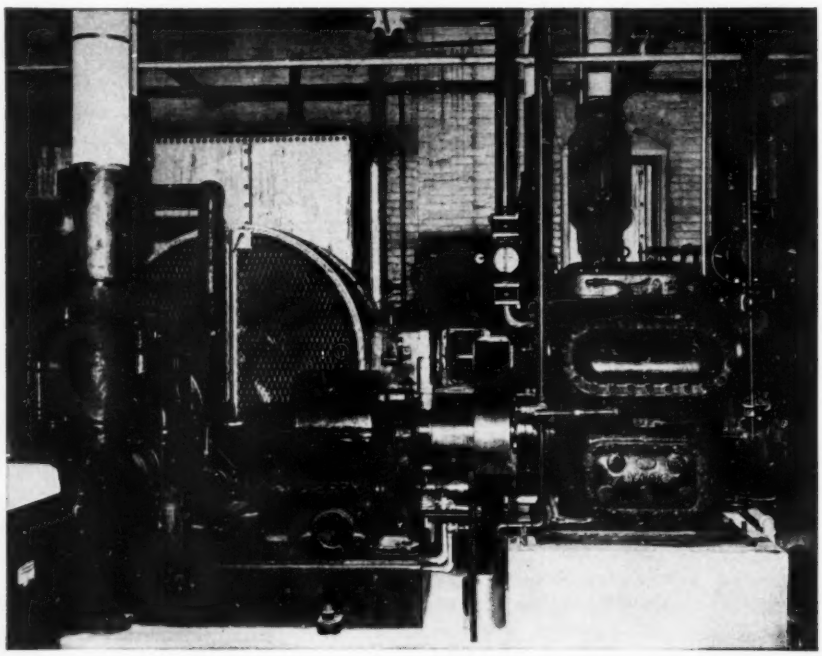
MANUFACTURING & ENGINEERING CORPORATION

TWO PARK AVENUE, NEW YORK

***FACTORY* DANVILLE, PA.**

the Terry Turbine





Refrigeration Compressor Driven By Terry Turbine

AT HAMPDEN BREWERY

This 150 hp Terry Turbine — at the Willimansett, Mass. plant of the Hampden Brewing Co. — operates at 3800 rpm with a gear reducing it to 720 rpm. It is coupled to a 6 cylinder reciprocating compressor.

The installation is running on steam conditions of 120 psi — 0° superheat, and the steam to the turbine is automatically throttled to maintain a constant 30 psi back pressure for process and heating. The installation was developed by Fred Ophuls & Associates Consulting Engineers.

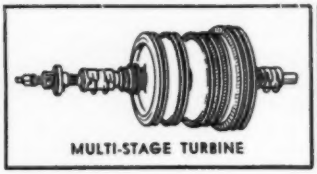
Get more information on the wide range line of Terry Turbines from your local District Representative. There's no obligation for a complete discussion of your specific requirements. Also send for Bulletin S-143 that gives full details.

THE TERRY STEAM TURBINE CO.

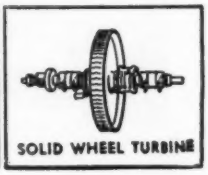
TERRY SQUARE, HARTFORD 1, CONN.

TT-1186

Terry

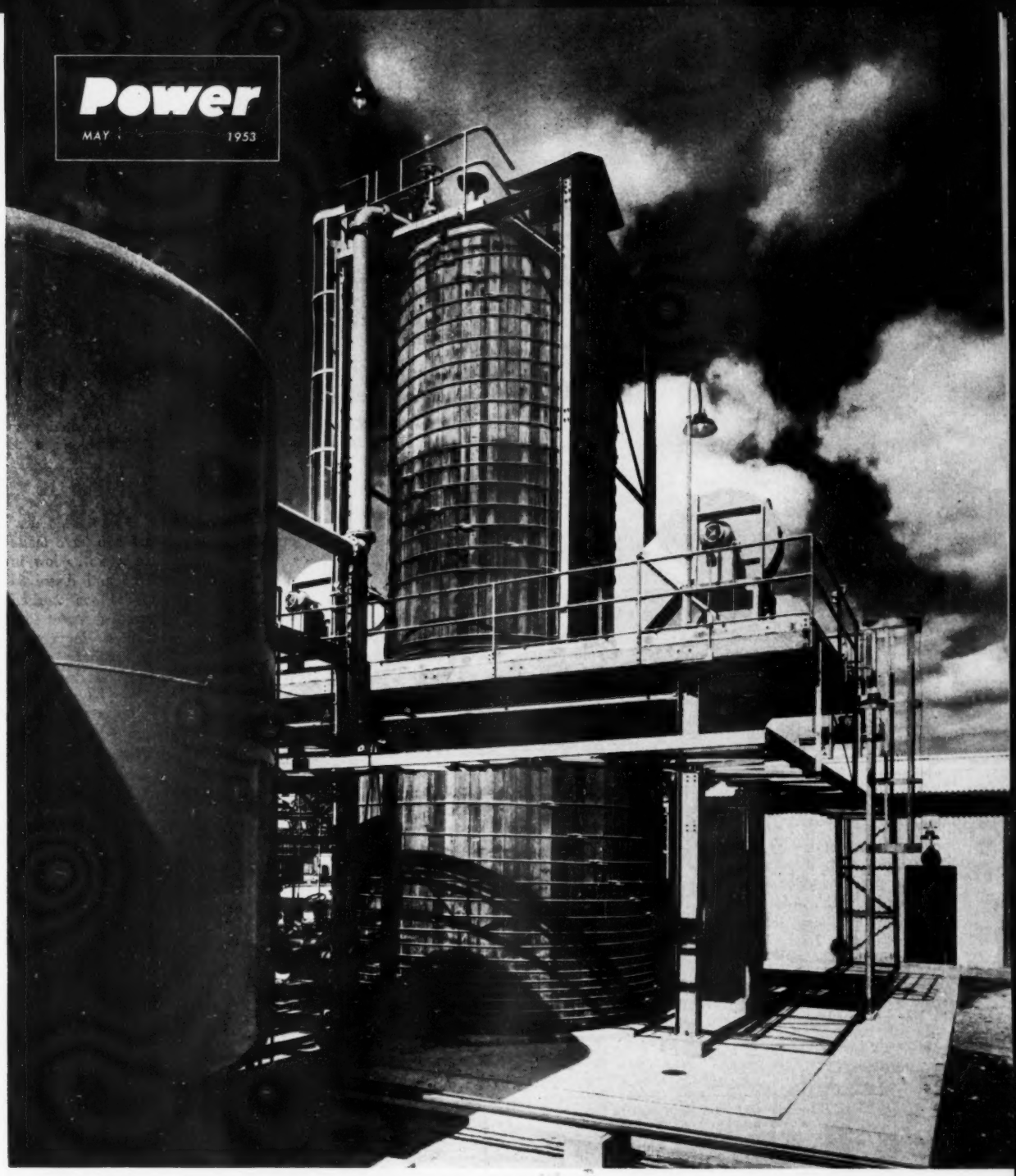


MULTI-STAGE TURBINE



SOLID WHEEL TURBINE

Power
MAY 1953

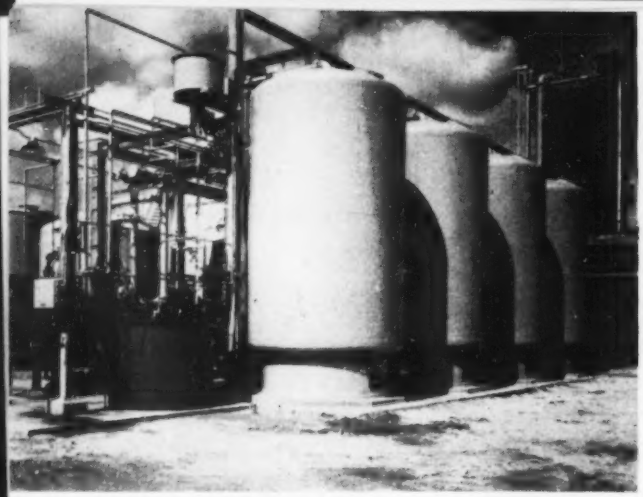


THIS DEGASIFIER, wooden tower, forms a vital part of the 2-step treatment but is omitted in the mixed-bed method

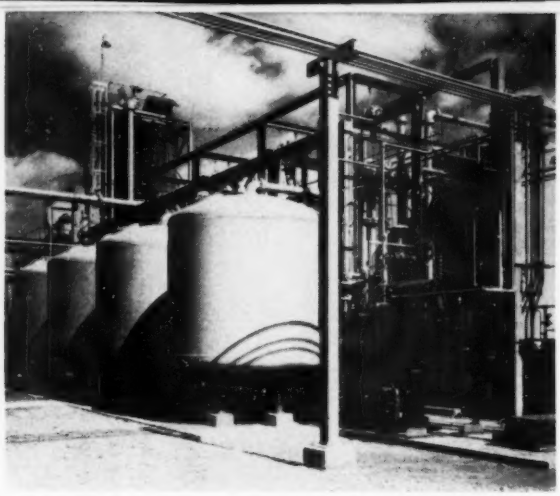
Mixed-Bed vs 2-Step Demineralizing

M E GILWOOD, *Director of Research,* **DR C CALMON,** *Chief Research Chemist, Permutit Co*

Turn page for details comparing these two water-treatment contenders



CATION-EXCHANGER UNIT takes raw water and converts its metal salts to the acid form before it enters degasifier, *right*



CARBONIC ACID breaks down in degasifier, gas is aerated, then anion exchanger removes sulfuric, silicic, hydrochloric acids

DEMINERALIZATION *continued*

► EVER SINCE the development of mixed-bed demineralization, right on the heels of the earlier 2-step treatment, the inevitable questions have been coming up. How do they compare? Where is each best suited?

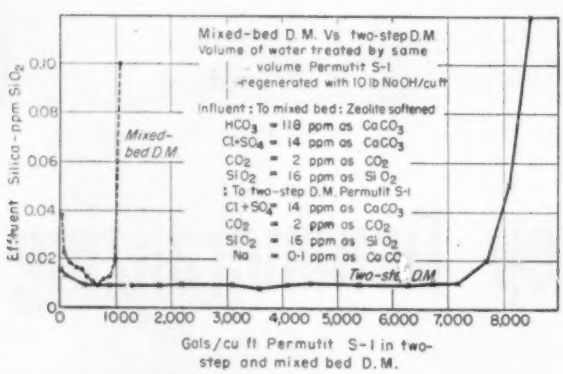
Several mixed-bed installations have been purchased in the last few years for high-pressure power plants but only one or two, to our knowledge, are actually in operation. So field data on the mixed-bed process are still scarce. Here, however, is a report of some extensive comparison studies (about 100 on a mixed-bed unit, 50 on a 2-step arrangement) to determine silica-removal effectiveness. [*Ed. Note:* These studies provided the material for a paper, "Mixed-Bed vs 2-Step Demineralization of High-Pressure Boiler Feedwater," by the same authors before the Second American Power Conference, Chicago.]

For power-plant makeup needs, each system gives good results. Both the 2-step and the mixed-bed systems produce treated waters containing silica levels of 0.1-ppm dissolved SiO_2, or lower. What's more, each can turn out a treated water of low electrolyte content, 5 ppm or less. The mixed-bed process can further supply a treated water with a conductive electrolyte content between 0.1 to 0.2 ppm.

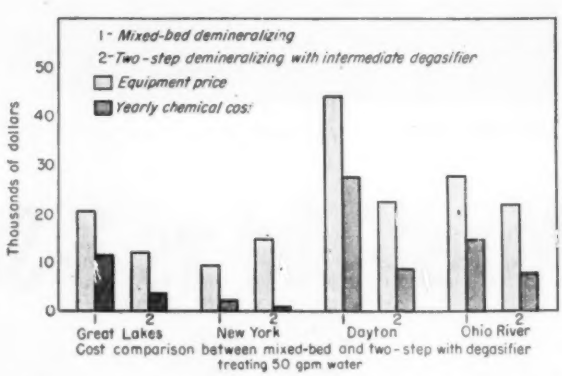
A low-conductivity water like this proves highly valuable in certain industrial-process applications, but it doesn't mean much in power-plant work. Especially so in light of the common practice of adding phosphates, sulfites and hydroxides to boiler makeup water to protect boiler and piping against corrosion and deposits. Yet other factors, worth considering, show up better when you compare the operating steps of each system and how they influence final results. Here is a brief description of the theory behind each design.

Two-Step Demineralization. Strongly basic anion exchangers coming on the market about six years ago have made it possible to produce a water low in both electrolyte content and dissolved silica. These exchangers are worked into the 2-step demineralizer-treatment system, as shown in flow diagram, p 75. First step is the hydrogen cation exchanger followed up by a degasifier, and then the second or highly basic anion-exchanger step.

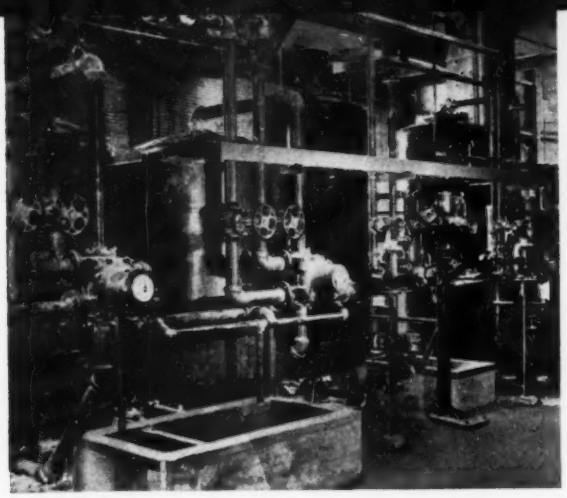
When the raw water passes through the hydrogen cation exchanger the calcium, magnesium and sodium cations drop out of the water in favor of the hydrogen ions. Raw-water salts undergo conversion to their corresponding acids —sulfuric, hydrochloric, carbonic and silicic acids. The converted water making up the hydrogen cation-exchanger effluent enters the degasifier, diagram, p 75, where the dissolved carbonic acid decomposes into water and carbon-dioxide gas. Aeration then removes the gas. The now-degasified water enters the highly basic anion exchanger where the sulfuric, hydrochloric and silicic



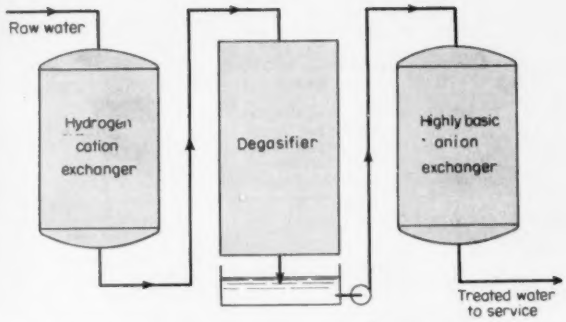
EXCHANGE CAPACITY of anion resin, Permutit S-1, differed sharply between two demineralization methods, curves, above



ECONOMY considerations indicate mixed-bed method offers advantages for waters of low total solids like New York's



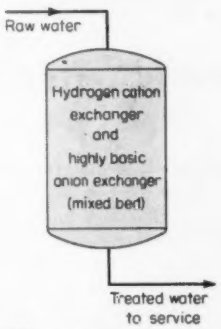
MIXED BED receives a filtered raw water and does all the removal of unwanted soluble impurities within a single tank



TWO-STEP demineralization follows this flow diagram. Sodium ions can leak through the cation stage and need watching

Typical Analysis of Raw Water for Demineralization

	Ppm as	Great Lakes	New York (Catskill)	Dayton, Ohio	Ohio River
Total hardness	$CaCO_3$	124	20	370	126
Sodium	$CaCO_3$	16	5	20	72
MO Alkalinity	$CaCO_3$	98	12	278	45
Chloride & sulfate (ThMA)	$CACO_3$	42	13	112	153
Silica	SiO_2	4	2.4	10	16



MIXED-BED treatment, with no degasifier, has carbonates as an extra load

acids plus any residual carbon dioxide is removed.

Mixed-Bed Process. Against this 2-step procedure with an intermediate degasifier stage, the mixed-bed method does the entire operation within a single tank, flow diagram, above. Before each run the hydrogen cation and the highly basic anion exchangers undergo thorough mixing to form a single, uniform bed. Raw water flowing through this bed comes in contact with cation and anion exchange particles all the way along its passage. The effect is similar to that of passing the water through a large number of individual demineralizing steps set up in series. Further, it answers one complaint against the separate-step treatment by eliminating all traces of cation slippage.

The purified water contains so small an amount of electrolyte impurities, conventional water-analysis procedures don't give accurate reports. In their stead conductivity measurements are made.

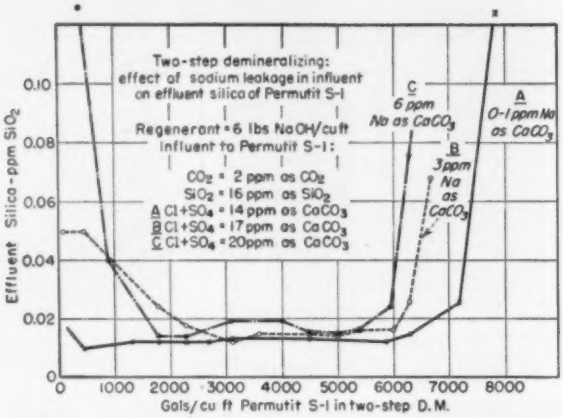
During the time the raw water runs through the mixed bed the hydrogen ions take the place of the removed calcium, magnesium and sodium cations to form an equivalent amount of the corresponding acids. The anion-exchange resin acts on these acids in the same way it does in the 2-step process. At the end of the run the anion and cation resins are separated hydraulically to form individual beds and they are then regenerated within the unit. Remember, there is no degasifying step so the carbonic acid cannot be disposed of in this way and must be removed entirely by the anion-exchange resin—an extra load for this resin compared to 2-step demineralization.

Test Conditions. With the above differences generally understood we felt a series of comparative tests for silica removal would add more data toward a good comparison basis. So we set up a number of parallel tests for both methods treating the same water with the same cation, Permutit Q, and a Type I, highly basic anion-exchange resin, Permutit S-1. Type I anion exchangers give lower silica residuals and prove more stable toward high-temperature caustic regenerant than do other types. The same volume of anion exchanger, incidentally, was added to each test unit.

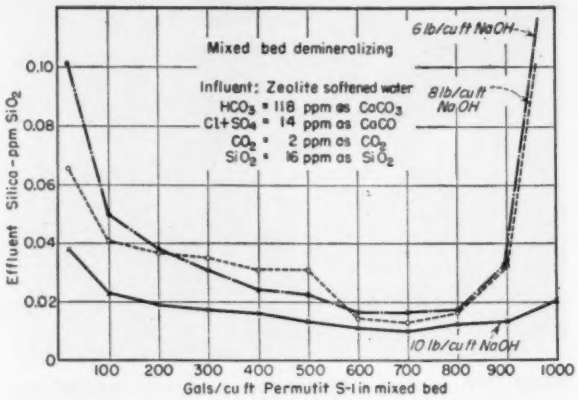
Our test water had an MO alkalinity of 118 ppm, as $CaCO_3$, 2 ppm CO_2, 16 ppm Si_2 as SiO_2, and chlorides and sulfates together of 14 ppm as $CaCO_3$. The anion regenerant was applied as a 5% NaOH solution at 130 F. Silica determinations were made by the Armour Institute method.

Sodium Leakage. Depending on the chloride and sulfate content of the raw water, the cation-exchanger and the acid-regenerant conditions, some sodium ions always leak through the cation-exchange unit of the 2-step demineralizer. This leakage you can hold to low levels, less than 2 ppm, by proper selection of cation exchanger and use of right regenerant procedure.

Chart, left, p 76, shows the results of repeated test runs on a 2-step system. Note particularly the sodium in the water after it has been degasified and treated in the hydrogen cation exchanger. As it enters the Permutit S bed, sodium is varied from 0 to 6 ppm as $CaCO_3$. The effluent silica during the flat portion of the runs increases slightly from 0.012 to 0.016 ppm as sodium content of the entering water rises. At the same time, as the influent sodium goes up more water has to pass through the


Two-step demineralizing:
effect of sodium leakage in influent
on effluent silica of Permutit S-1
Regenerant = 6 lbs NaOH/cu ft
Influent to Permutit S-1:
CO_2 = 2 ppm as CO_2
SiO_2 = 16 ppm as SiO_2
A Cl+SO_4 = 14 ppm as $CaCO_3$
B Cl+SO_4 = 17 ppm as $CaCO_3$
C Cl+SO_4 = 20ppm as $CaCO_3$
C 6 ppm Na as $CaCO_3$
B 3ppm Na as $CaCO_3$
A 0-1 ppm Na as $CaCO_3$
Effluent Silica - ppm SiO_2
Gals/cu ft Permutit S-1 in two-step D.M.

TESTS on sodium leakage effect, on final results with 2-step treatment, point out need to hold the sodium to low level


Mixed bed demineralizing
Influent: Zeolite softened water
HCO_3 = 118 ppm as $CaCO_3$
Cl+SO_4 = 14 ppm as CaCO
CO_2 = 2 ppm as CO_2
SiO_2 = 16 ppm as SiO_2
6 lb/cu ft NaOH
8 lb/cu ft NaOH
10 lb/cu ft NaOH
Effluent Silica - ppm SiO_2
Gals/cu ft Permutit S-1 in mixed bed

REGENERANT dosages have to be strong, about 10 lb NaOH per cu ft, with a mixed-bed unit to get good, low silica effluent

Controlled Tests Point Up Difficulties in Ion Exchange

anion-exchange bed before you reach the flat part of the run as far as silica is concerned. In an actual plant you meet this requirement easily by lengthening the rinse to give a low-effluent silica during the rinse recycling. But certainly for best results with 2-bed operation, sodium in the water entering the anion-exchange unit must be held as low as possible.

Regenerant Caustic. Further, we found it difficult to get a good, low-silica effluent of about 0.01 to 0.02 ppm of residual silica from a mixed-bed unit unless we kept regenerant dosages at about 10 lb of sodium hydroxide per cu ft of the resin, right, above. A dosage level down around 6 lb of NaOH per cu ft produced an effluent silica appreciably higher than 0.02 ppm. On the other hand, you can get the 0.01 to 0.02 ppm silica with a 6-lb NaOH regenerant dosage in a 2-bed demineralizer setup.

During the early runs, however, while the mixed bed was still young we could readily reduce effluent silica to 0.01 ppm of SiO_2, or less, employing NaOH at 130 F and in sufficient dosage. But as the bed got older it became increasingly difficult to maintain this silica quality. Even acid washings failed to restore the anion exchanger to its original silica-reducing ability.

Anion-Exchange Capacities. Our tests showed us that the anion-exchanger capacity in kg per cu ft is much lower in the mixed bed than in the 2-step operation. It averaged about 8 kg per cu ft of anion removal for Permutit S-1 in a mixed bed employing 10 lb of NaOH regenerant per cu ft of resin. Under the same conditions the Permutit S-1 averaged 14 kg per cu ft capacity with a 2-step system. The anion load in the mixed bed ran higher because of the 118-ppm load from the bicarbonate alkalinity in the raw water.

Between the extra anion load and the reduced exchange capacity of the Permutit S-1 in the mixed-bed design an appreciably smaller amount of water could be treated by this system per run for the same volume of anion-exchange resin than with a 2-step unit. Fig. 5 illustrates the considerable differences with the two methods. The results do show, however, that you can get a demineralized water of a silica content between 0.01- to 0.02-ppm SiO_2 with both the mixed- and the 2-bed methods. But it takes carefully controlled conditions to assure these results.

Silica and Anion Ratio. Our test water carried a high ratio of silica to total anions, about 1 to 1. So we have begun tests to determine the effect of this ratio. Already indications point to the fact that the desirable, extremely low silica residual can be attained much easier for a 2-bed unit handling waters with a ratio of 1 part silica to 5 total anions. The higher this ratio gets, the more vigorous are the regenerant conditions you have to maintain to get the same results.

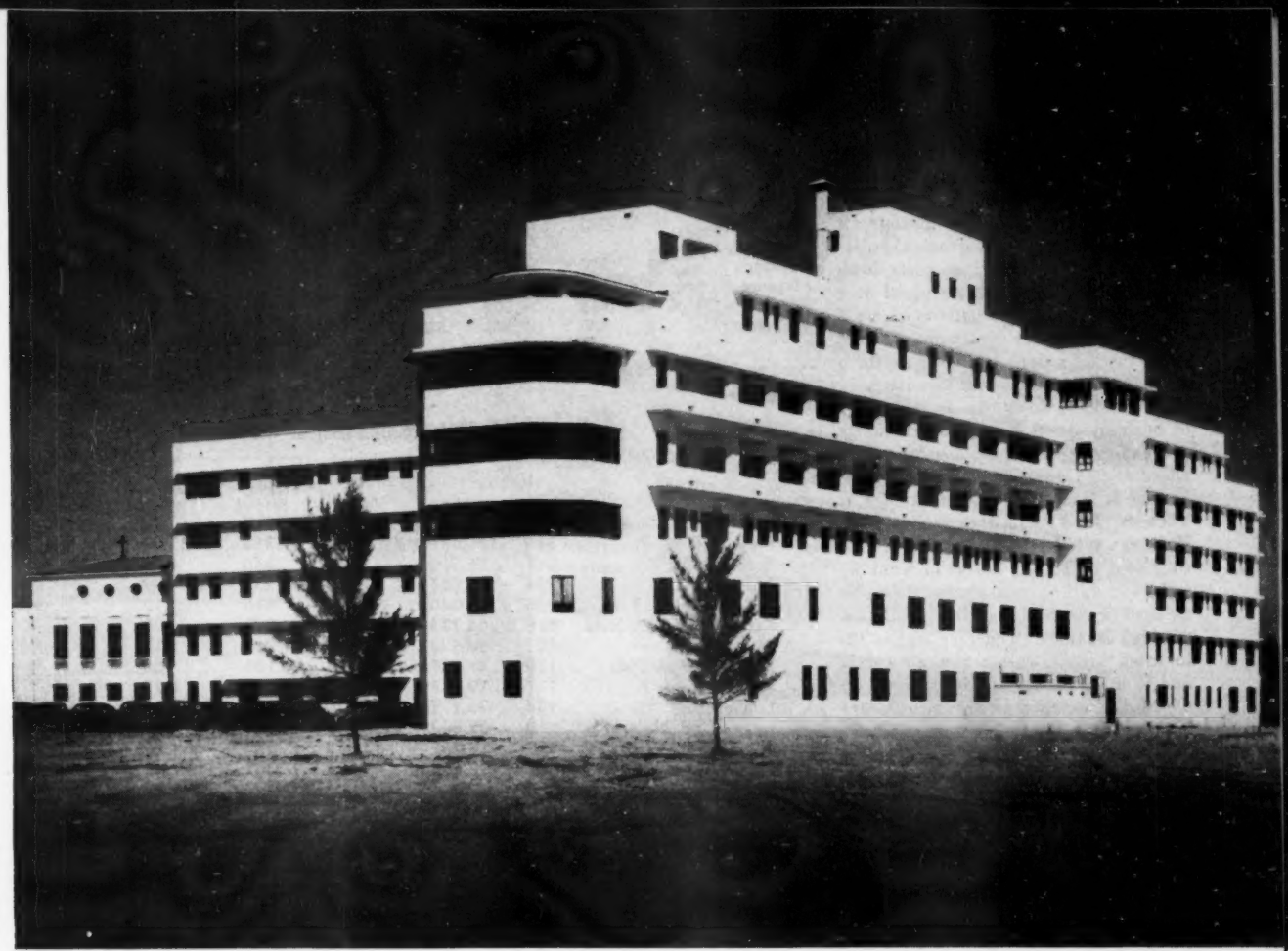
From this ratio experience it would seem the mixed-bed process, with the bicarbonates still in, would improve the silica to total anion ratio, and give better silica residuals. This has not proved out in practice, though. In fact, by close control of the sodium in the influent to the anion exchanger it appears easier to obtain silica removal to the 0.01-ppm level with the 2-bed than with the mixed-bed demineralization process. Our tests, though, are still being carried out.

Iron Effect. Dissolved iron in the influent to the anion exchanger raises severe problems. It coats out on the exchange resin and allows silica residuals to climb in the effluent. With the 2-step demineralizer the hydrogen-cation exchanger removes much of the dissolved iron in the raw water. Mixed-bed units suffer because the dissolved iron comes into ready contact with the anion-exchange resin. For the same reason other precipitants, a high raw-water hardness, and measurable turbidity add to the mixed-bed operating problems.

To combat these problems, it is desirable to soften at least the regenerating and rinsing water meant for the anion-exchange portion of the mixed bed. Frequently a filter bed ahead of the mixed bed will prevent eventual clogging in the unit.*

Economic Comparison. Table shows the typical raw waters handled by demineralization processes. With some waters the mixed bed has advantages. Chart, at right on p 74, portrays comparative costs except for erection, filters and softeners for a 50-gpm single-unit installation employing both mixed- and 2-bed operation.

When treating a low-solids water like New York City's Catskill supply the mixed-bed equipment runs much lower than for a 2-step design. Chemical costs with this raw water are not too great. But when you leave the low-solids waters (30-75 ppm) first cost and chemical costs combine to make the mixed-bed system relatively expensive.



MODERN HOSPITALS feature striking buildings, ample space. Yet they can be penalized if mechanical plant design is antiquated

Hospitals Need Mechanical Know-How

• One-third the investment in a hospital is for heating and mechanical plant

• Fuel costs alone vary from $75 to $256 per bed a year, depending on building design

• Standby boiler capacity often goes in oversize, designed to meet extreme peaks, not base or average

By C F NEERGAARD, *Hospital Consultant*
Neergaard, Agnew and Craig
New York and Toronto

► IN THE AVERAGE HOSPITAL, cost of heating and mechanical plant represents upwards of one-third of the total investment. Its operation and maintenance bulk large in the yearly budget. Yet hospitals as an industry have never analyzed their precise needs. The answer is what you might expect—usually too much equipment for the job at hand. Here are some guides to good planning in this long-neglected field.

For years, architects, engineers and hospital building committees have felt the lack of simple, authoritative yardsticks to judge the requirements for power, heat, ventilation, air-conditioning, electrical equipment. Potentially the most valuable aid along these lines is the mechanical section of U.S. Public Health Service's publication, *Functional Basis of Hospital Planning*, put out by the Division of Hospital Facilities, Washington, D.C. Let's see now what's been going on in the hospital field and try to draw some lessons.

Hospital bookkeeping usually groups power, light and heat in one account. But the bulk of the expenditures in this account are for heat. **Fuel, alone,** amounts to about 40% of the total. Tables I and II, on page 78, present a challenging comparison.

The five hospitals making up Table I spend from $74 to $188 a year per bed with 1950 fuel prices. Those making up Table II run all the way from $186 to $447 a year per bed. Major difference is the factor of insulation. Table I entries enjoy insulation in one-quarter to one-half the building area. The answer seems obvious. Yet its lesson is largely overlooked.

In 1947, 36 hospitals in the New York area with 6906 beds spent an aggregate

of $1,770,000 for power, light and heat. Fuel alone cost $690,000. This represents an average of $256 a bed for the mechanical services. If we were to build these hospitals today, fully insulate all buildings and design economical boiler plants, we could hold these costs down to around $75 a bed—a saving of over one million dollars. What's more, as a firm, we personally feel panel heating could further reduce fuel costs as much as 25%! But more about this later.

Insulation vs Radiation. In the course of business we've met many architects and engineers who claim hospitals can't afford the expense of insulation. Let's analyze it from first-hand experience at Yonkers, N. Y. and Hagerstown, Md. Here the typical room has an outside wall area of 130 sq ft—36 in windows and 94 in wall. For insulating the walls we used fireproofed fiber furring blocks, 20x80x3 in. thick. Together with a 12-in. brick curtain wall, a 2-in. air space, and ½ in. of plaster applied directly on the blocks, we got a heat-loss coefficient of 0.1065 Btu per sq ft per hr.

At the time of purchase, this furring block ran 35c a foot, but we could lay it up in a third less time than the usual 15c split-tile furring it replaces.

The hermetically-sealed double glazing cost $2.50 a foot as against 35c for the double-thick glass. Allowing for extra labor on installation the selected windows run $2.25 a foot more.

Thus to insulate the typical room described above we paid 20c extra for 94 sq ft of wall or $18.80, and $2.25 extra for 36 sq ft of window, or $81, a total of $99.80. So much for insulation extras.

For radiation in the insulated room at Hagerstown we selected 28 sq ft, and at Yonkers, 48 sq ft.

Three contractors indicated they based their unit-estimating costs for installation of a complete heating plant at $5.75-$8.00 a sq ft of radiation (1950 levels). In the interests of extreme conservatism let's say $5.00 per sq ft. The 20 sq ft less radiation at Hagerstown saved $100 a room, the full cost of the insulation. Fuel consumption is substantially cut in half for the life of the building. What's more, the insulated building in three controlled tests has proved 8 deg cooler in summer than an adjoining uninsulated structure.

This subject of radiation suffers from what our firm feels are outmoded ideas. For too long, architects and engineers have revered the 18th-Century tradition calling for a radiator under every window. It costs roughly $30 to hook up and valve each radiator and doubling up is rank extravagance.

Heat requirements may be roughly estimated at a ratio of 1 sq ft of radiation to 80 cu ft of space, and double that, or 160 cu ft of space, if the building is properly insulated. Table III indicates the wide spread in engineering design and the varied allowance made for insulation. This variation is further emphasized by the following examples of the amount of radiation in rooms of identical size and construction heated with hot-water radiators.

1. Yonkers, N. Y.—on a hill above the Hudson River, with extreme exposure —has 48 sq ft of radiation and ¾-in. radiator connections in the typical room.

2. Port Chester, N. Y.—20 miles away, in a sheltered valley—has 62 sq ft of radiation with 1¼-in. connections.

3. Hagerstown, Md.—fully insulated walls, double-glazed windows—needs only 28 sq ft of radiation with seamless-copper-tubing connections.

4. Bethlehem, Pa.—with the double-corridor plan—requires only 1 sq ft of radiation to each 200 cu ft of space.

I: Hospital With All or a Portion Insulated

Location	No. beds	Days care	Total cost	Power, light per bed per yr	Heat cost patient per day	Proportion insulated
Toronto, Ont.	547	175,488	$40,622	$ 74	$0.23	½
Prince Edward Island, Canada	200	54,037	19,373	97	.36	All
Hagerstown, Md.	170	57,783	27,718	163	.48	½
Glens Falls, N. Y.	162	59,208	19,048	117	.32	½
Bethlehem, Pa.	307	89,001	58,153	188	.65	¼

II: Hospitals That Are Uninsulated

Location	No. beds	Days care	Total cost	Power, light, per bed per yr	Heat cost patient per day
New York, N. Y.	520	152,686	$163,129	$314	$1.07
Brooklyn, N. Y.	341	96,966	117,897	346	1.22
New Jersey	284	71,856	71,367	251	.99
Long Island, N. Y.	236	69,040	77,023	326	1.12
Central New York State	218	66,323	43,509	200	.66
New Jersey	207	56,588	65,317	316	1.16
No. New York State	150	41,959	27,828	186	.66
New York, N. Y.	131	29,741	58,541	447	1.97
Connecticut	134	36,157	43,130	322	1.19
Long Island, N. Y.	110	32,843	36,775	334	1.12
Westchester Cty, N. Y.	100	28,261	33,975	340	1.20
Brooklyn, N. Y.	143	30,288	43,875	307	1.45

The local figures are from a group of hospitals with uniform accounting.

III: Comparison of Radiation With and Without Insulation

Hospitals completed	Cu ft of building	Sq ft of radiation	No. of cu ft to ea sq ft of radiation	Insulation — Walls	Insulation — Windows
Prince Edward Island, Can.	550,000	5,100	107	Yes	Yes
Bethlehem, Pa.	750,000	3,750	200	Yes	Yes
Hagerstown, Md.	560,000	3,590	156	Yes	Yes
New Haven, Conn.	1,605,000	13,248	121	Yes	Yes
Toronto, Ont.	1,880,000	16,600	113	Yes	Yes
Hospitals being planned					
Scranton, Pa.	333,000	3,343	99	Yes	No
Long Island, N. Y.	514,000	7,320	70	Yes	No
New Jersey	425,000	6,600	65	No	No
Glens Falls, N. Y.	605,000	7,400	85	Yes	No
Virginia	1,137,521	23,813	47	Yes	No

Heating contractors roughly estimate heating-plant installations @ $6.50 per sq ft of radiation, including boilers and equipment.

In first group all except Prince Edward Island are wings added to existing structures.

IV: Steam Requirements for 100-Bed Hospital

Use	Maximum hp	Steam pressure	Hours a day at varying loads
Gen'l heating system	68	2	24
Special heating: operating, delivery rooms	2	2	6
Domestic hot water	10	2	16
Laundry: Hot water	15	2	7
Steam	11	100	7
Kitchen, dishwashing	6	2-20	6
Sterilizing	10	40	5
Total	122		

Cold-blooded appraisal of steam needs, Table IV, and knowledge of today's boiler availabilities confirm size savings that limit capacity to one boiler hp or less a bed, Table V. What's more, this rule has been proved over and over.

V: Hospital Plants With One Boiler Horsepower or Less per Bed

Location	Erected*	Bldgs	No. beds	No. boilers	Boiler Hp Winter	Boiler Hp Standby	Approx space insulated
Brooklyn, N. Y.	1918	3	100	2	100	100	0
Hagerstown, Md.	1936	5	158	2	130	130	⅓
Bethlehem, Pa.	1945	11	295	3	300	150	¼
Stamford, Conn.	1940	2	70	2	60	60	0
Bangor, Me.	1940	8	213	3	136	2 @ 60	¼
Rome, N. Y.	1939	1	135	3	109	2 @ 63	0
New Haven, Conn.	1941	8	385	3	300	150	½
Westchester, Cty., N.Y.	1945	4	145	3	150	2 @ 100	0
Glens Falls, N. Y.	1936	2	162	3	150	150-60	½
Prince Edward Is., Can.	1937	2	200	2	60	60	All
Toronto, Ont.	1932	4	547	2	250	250	½
White Plains, N. Y.	1939	4	196	3	160	2 @ 106	½
Yonkers, N. Y.	1929	6	195	2	125	125	None
Total			2,801		3923		
Average hp per bed 1.4							

*Date erected is for most recent building when usually a new, large boiler was installed to carry the winter load.
Only at Bangor and Rome were boilers designed economically to supply the reduced steam demand in summer. Rome has a 109-hp low-pressure and two 63-hp high-pressure.

No radiators at all in center service areas with no outside wall exposure.

Table IV gives a very good summary of the total steam requirements for a 100-bed hospital. These demands, as this table lists them, for hospital needs other than heating, represent only a third of the estimated total boiler load.

Boiler Plant. U.S. Public Health Service publication, referred to before, suggests no more than one boiler horsepower* per bed when the heat load is figured at zero F. We have records of 13 hospitals, Table V, with a total of 2800 beds where boilers of one hp per bed, usually less, have carried the winter load. Total boiler capacity in these institutions, including standby, average 1.4 hp per bed. Six general hospitals in New York City, on the other hand, with 2900 beds have boiler plants averaging 2.6 hp per bed.

The problem of standby boiler capacity is no small one. We have found that most engineers specify two high-pressure boilers, each sufficient to carry the winter load. But this premise entirely disregards the summertime drop-off to about a third of this load. So for five or six months a year one large boiler operates at a load level way below rated and at its most inefficient performance range.

The most economical boiler installation, for our money, for a 100-bed hospital, Table IV, combines a 70-hp steel hot-water heating boiler with two 40-hp 125-psi designs, a saving of 50 hp over the conventional two 100-hp 125-psi units. The hot-water heating boiler costs less than the high-pressure units. You can repair or recondition it in the summer months. In event of a winter breakdown you can get by comfortably with the two 40-hp high-pressure units. A check back on Table IV indicates that with the variable demands you have to meet, the two high-pressure boilers need work at 125% rated capacity for only relatively limited periods.

Heating Methods. As long ago as 1937, a study, put out by the Central Bureau of Hospital Information, London, England, presented panel-heating advantages so strongly that, as a firm, we felt its inclusion in American hospitals was a certainty. Greatest objection seems to be first cost. The impression exists with many architects, engineers and contractors that panel heating runs 20 to 30% more than a radiator job. However, from a business standpoint, we're convinced that given insulated buildings, proper structural and heating design, it should cost less to install than radiators. Prefabricated coils in flat-slab construction eliminate hung ceilings and plaster, save weight and cubage; cushioned floors would control sound transmission.

Two recent projects in our office confirm this belief. One small hospital in Rhode Island drew up alternate plans for a circulating hot-water system, and panel heating with prefabricated ceiling coils cast in a thin, concrete floor slab. An experienced heating contractor bid and saved 10% on a highly successful panel installation for this hospital.

An article in *Schweizerische Bauzeitung*, April 19, 1947, bears out this belief. It reports on the operating experience of 170 panel-heating installations in Switzerland from 1937 to 1947. There were 34 in hospitals, 85 in office buildings, schools, etc, and 51 in residences. Total tube length was 450 miles. Results were excellent and, significantly, no tube leaks were reported.

Mechanical Ventilation. One of the big hidden leaks in hospital construction and operation budgets has been too much ventilation. Given plenty of windows, a forced fresh-air system is rarely if ever justified, particularly so, when you consider the extra boiler capacity you need to heat the induced air. Small local, fractional-horsepower fans will do the job well enough. There is no point in going to the large central fans popular in the past.

Operation, Maintenance. In the last analysis, though, much of a hospital's experience with its mechanical services is wrapped up solidly with its operating engineer. In the average hospital he maintains buildings and grounds as well as running mechanical plant. Since the public notices broken shades and peeling paint more than a leaking steam valve or a dirty boiler, first consideration usually goes to this housekeeping phase.

For our money it would be smart and economical to retain the consulting engineer who designed a hospital's plant to inspect it at least twice a year and supervise an efficient operating and maintenance program.

*Frequently POWER has stated its position on the term "boiler horsepower." But where it has been a factor in making estimates, as in hospital work, its use may be condoned.—Ed.

HIGH-DENSITY BURUNDUM in the form of small cylinders proves to be efficient grinding medium to reduce coal samples for analysis. Tests show insignificant contamination of the sample and real time saving in length of grinding operation

High-Density Burundum Speeds Up Coal Crushing for Laboratory Analyses

Effective testing of coal characteristics calls for pulverizing samples to a given fineness. Here is a report on effectiveness of the crushing medium in ball mills, to speed up the job of preparing coal samples—possible savings in both time and money

By WALTER W PERKINS, *Chief Ceramist, U.S. Stoneware Co*

► COAL IS ONE of the most tested materials used by industry. The coal user wants to be assured he's getting all the fuel he's paid for, and the producer has to know whether he is meeting the customer's specifications. Because of this two-way interest, numerous laboratories are kept busy just testing coal.

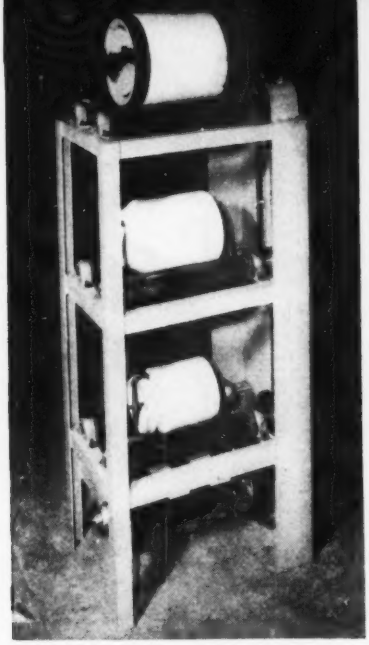
Test Methods. Many standard test procedures have evolved that the different laboratories use with little or no local variations. Descriptions of these tests appear in Part V of the 1949 *American Society for Testing Materials Standards*, pp 575 to 684, and in Bulletin 492 of the Bureau of Mines, *Methods of Analyzing Coal and Coke*.

Accuracy and speed of making the analysis are important for all laboratories, whether run by the coal-using or coal-producing businesses, or privately owned. An important step in the analysis concerns pulverizing of the coal sample. In present practice the coal sample received by the laboratory must be given a preliminary drying to bring its moisture in balance with atmospheric conditions.

After drying, the coal is crushed quickly by rolls to 20-mesh size and reduced by a riffle sampler to about 200 grams. The 200-gram sample is then crushed to sub 60-mesh particles. Both the Bureau of Mines and the ASTM suggest using 1-gallon ball mills, about half filled with ¾-in. diameter pebbles for this reduction process. The Bureau mentions rotational speeds of 45 to 50 rpm, while the *ASTM Standards* mentions speeds of 60 to 75 rpm.

According to these authorities, about 10 to 20 minutes are needed to break down bituminous coals, while about an hour is needed for anthracites. They agree that from 0.2 to 0.4% of the sample usually remains on the screen after the milling period. Since these coarse particles are likely to be the ash-forming substances, they are reduced by hand to pass the screen, and then mixed in with the bulk sample. The moisture, ash, volatile matter, elemental components, calorific value and fusibility of ash are found from this sub 60-mesh material.

Ball milling, as a coal-reduction method, has certain advantages. While



COAL MILL accommodating three pulverizing jars has a variable-speed drive

JAR MILLS hold coal sample and Burundum charge during grinding operations

being ground the material becomes well-mixed. Moisture staying in the jar keeps the coal more nearly representative of its induced equilibrium state. The abrasion causes no significant contamination of the sample. Ball milling is a relatively clean operation. After a run the jar can be emptied quickly, brushed free of residual particles, and be ready for another sample.

Jar mills can be made even more desirable by substituting smaller sizes for the presently accepted gallon ones. This eases the handling problem. Shorter dimensions and considerable gross-weight reduction make it possible for women or physically handicapped personnel to handle the jars more easily. Smaller jars, which are less costly, make possible some savings in space and in money.

Test Comparison. Two porcelain mill jars were used for comparative testing. The 0.48-gallon jar had a volume of about 1800 cc, and the 1.3-gallon jar a volume of about 5000 cc. With covers and hardware they have an empty weight of 8 and 16 lb, respectively.

Two samples of bituminous coal were tested in each size jar. The coals were crushed to a nominal 20 mesh by the laboratory of a large coal user. Size analysis of these two coals when dry were:

Sample	*I*	*II*
On 6 mesh	0.7%	0.05%
On 8 mesh	5.6%	0.4%
On 12 mesh	15.1%	5.7%
On 14 mesh	10.8%	7.7%
On 16 mesh	8.6%	8.6%
On 40 mesh	34.3%	40.5%
On 50 mesh	5.4%	8.0%
On 60 mesh	2.0%	3.1%
On 100 mesh	6.6%	10.8%
Through 100 mesh	10.9%	15.2%

Comparison tests were made to find the effect on particle size reduction of (1) different ratios of coal to media charges (2) rotational speed (3) time of run. Tests were run with flint-pebbles and high-density cylindrical-shaped Burundum as the crushing media. All the milling tests were run on a 3-tier variable-speed mill similar to the one in the photo above, left.

In the smaller jar, 3.5 lb of Burundum or 2.5 lb of flint with an 80-gram coal charge was best. It was decided, however, to work with 100-gram charges since it was more practical for the laboratory. The larger jar was most efficient with coal charges between 150 and 200 grams, and a Burundum charge of 10-12 lb. Loadings of over 200 grams of coal and 12 lb of media caused the effectiveness to fall off. No trials were made with flint in the larger jar.

Rotating speed proved an important factor in time needed for pulverizing with the small jars. Speed should be at least 110 rpm. Nature of the coal may have some bearing on the most effective speed. Sample I broke down more quickly and thoroughly with increasing speeds up to the machine limit of 124 rpm. Sample II reached a maximum between 110 and 115 rpm, then fell off in effectiveness, though not seriously.

Typical results, using 100 grams of coal sample II with 2.5 lb of flint and 3.5 lb of Burundum over a 20-minute milling period, were:

	% retained on 60 mesh	
Speed	*Flint*	*Burundum*
90 rpm	3.0	0.9
111 rpm	2.6	0.4
124 rpm	2.9	0.5

For the larger jar, speeds from 55 to 70 rpm seemed equally effective with 0.4% of the sample remaining on 60 mesh.

Rotation time effects were found as follows for a speed of 111 rpm with small jars:

	% retained on 60 mesh	
Time	*Flint*	*Burundum*
15 min	...	2.0
20 min	2.6	0.4
30 min	...	0.3
45 min	...	0.3
60 min	0.5	0.3

Up to 15 minutes, the sample is still relatively coarse with Burundum, while after 20 minutes there is little further gain. A time of 20 minutes was also critical with the large jar.

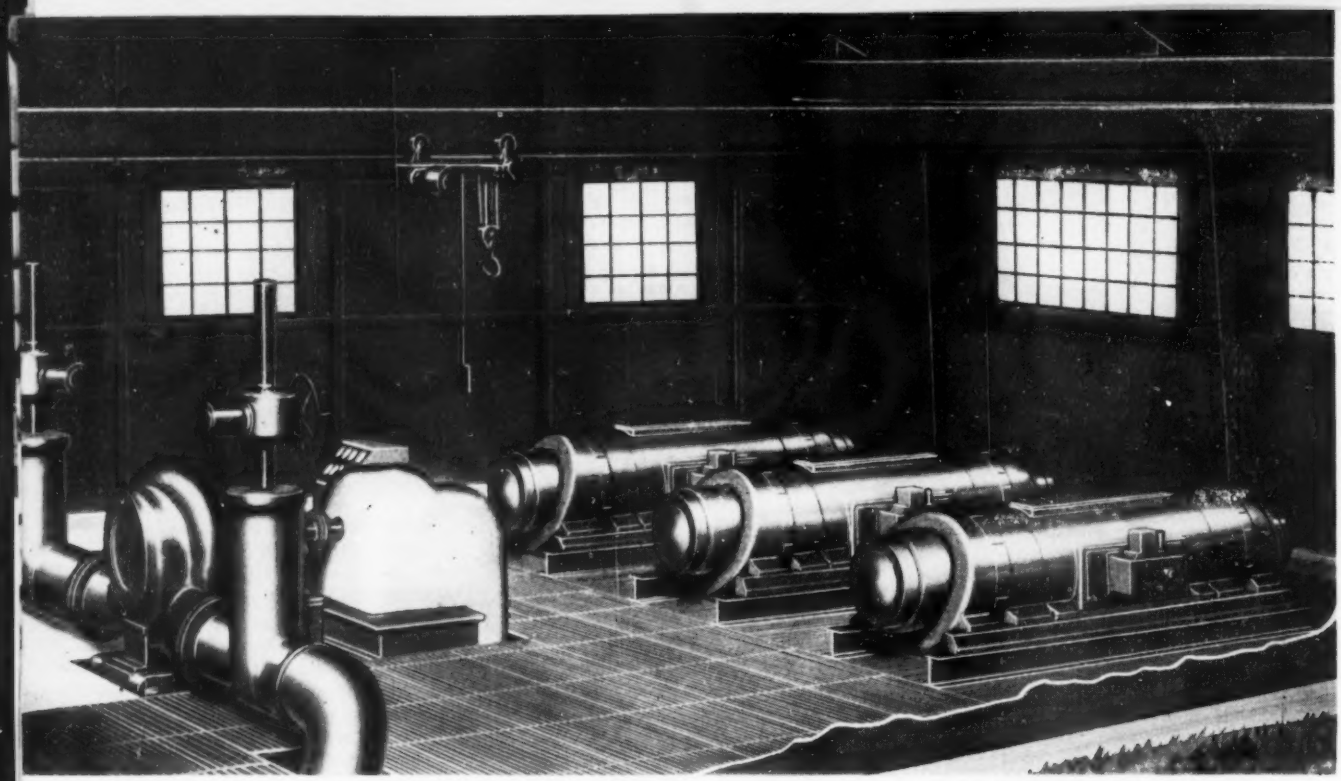
As a sidelight, grinding sample II up to an hour with both small and large jars did not completely pulverize the coal to pass through 60 mesh. Sample I broke up more readily.

The 60-mesh retention or passage is the most critical point in milling tests. Despite comparable size 60-mesh reduction, the larger jar produces less residue to be caught on a 100-mesh screen. For instance, in the small jars, 2.5 lb of flint with 100 grams of coal at 111 rpm left a *total* residue of about 29% on 100-mesh screen. On the other hand, 3.5 lb of Burundum under the same conditions left a total residue of 9.7%, while the large jar rotating at 67 rpm produced a residue of only 2.4% on the 100-mesh screen. Had only 80 grams of coal been used in the smaller jars, a better showing would have resulted, but this would be outside the limits imposed on this test project.

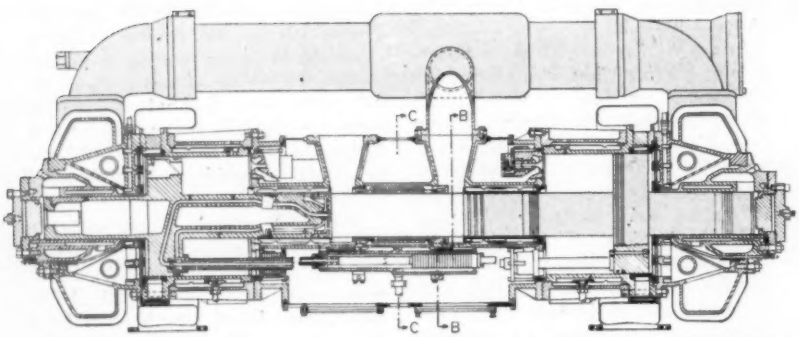
Results. Our work showed optimum conditions that will save time in preparing coal samples. Some of the conditions, such as media to coal charge ratios, when found, may be considered as constants, while that of speed may be varied as the coal differs. There is similar particle-size reduction through a 60-mesh screen of coal ground in either the 0.48- or 1.3-gallon jars.

We can conclude that for comparable results, a jar weighing no more than 11 lb, complete with charge, will do as acceptable a job as one weighing about 25-27 lb. The smaller physical dimensions expand the capacity of the mill itself.

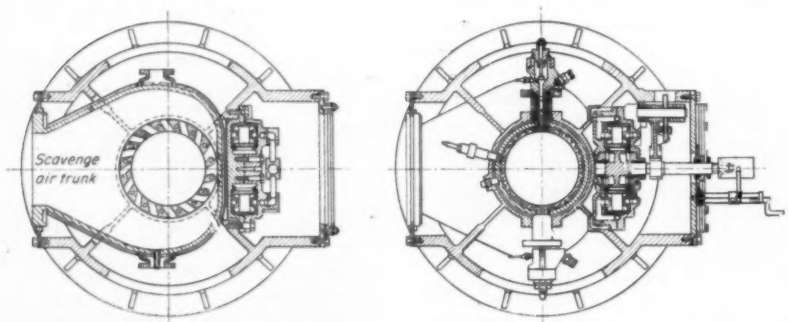
Unloading of jars is more convenient. There are fewer pieces of crushing media in the charge and less chance of contamination from residual matter. Variable-speed drives prove desirable because optimum speeds can be used as needed. High-density media prove better in rapid pulverization than flint.



1 Compact arrangement and low head room mark this 5000-hp gas-line compressor station. Three free-piston gas generators, *right*, feed 1000-F 72.5-psig gas to turbine, *at left center*, driving centrifugal gas-line compressor through gear



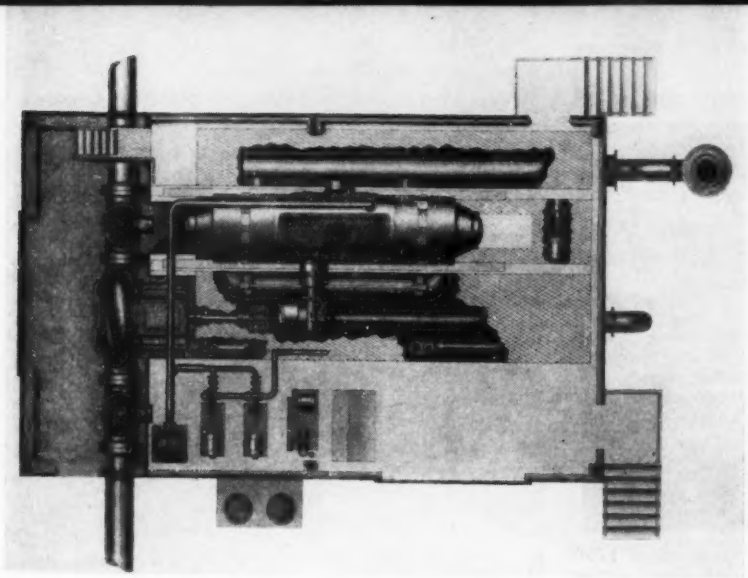
2 Model B free-piston generator compresses air on outward stroke. This Baldwin-Lima-Hamilton unit can develop 103-psig exhaust gas, run as fast as 1400 cpm



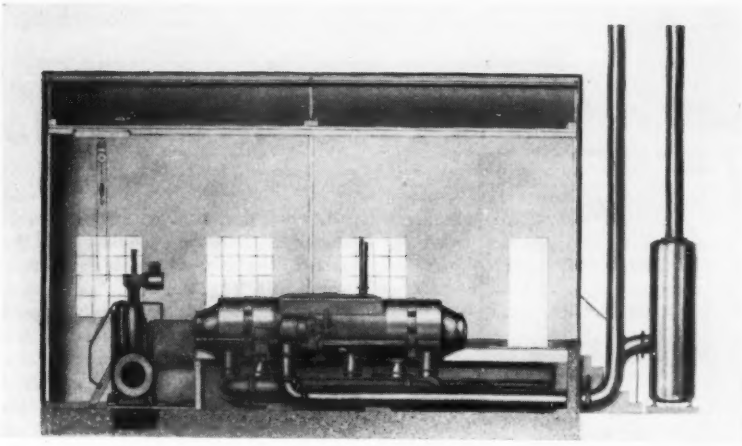
3 Cross sections through BLH Model B show arrangement of the air inlet to diesel cylinder, *left*, and fuel nozzles with synchronizing racks and gear, *at right*

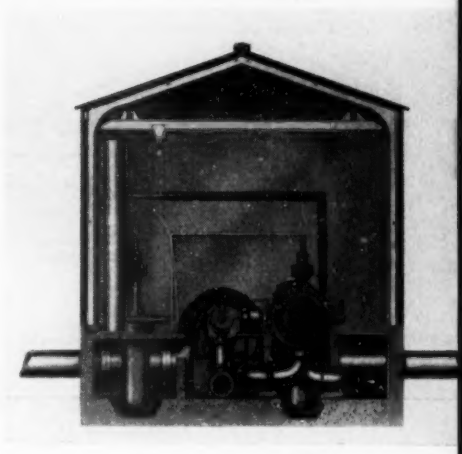
Free-Piston

Adapting reciprocating machinery as power-gas generators for gas turbines takes several forms depending on the job to be done. Free-piston gas generators offer a promising road to achieving high overall efficiency with limited need for high-temperature alloys. European activities blazed the trail for these developments in our country



4 These three views show details of a 1500-hp pipeline compressor station with one unit. A single free-piston power-gas generator supplies the driving turbine spinning at 14,400 rpm. Concrete mat supports all equipment. Column footings raise main machinery so that operating floor has a 4-ft space underneath to accommodate all connecting piping. This Cooper-Bessemer design and one in Fig. 1 take in air through air silencer standing outdoors. Turbine exhausts through the neighboring stack. All auxiliaries have separate power drives, simplifying starting procedure





Engine: U.S. Development in High Gear

► First reports of free-piston gas-generator development in this country were revealed before the ASME spring meeting in Columbus, Ohio, April 28-30, 1953, in three papers. These are: (1) *Performance of Free-Piston Gas Generators*, by J J McMullen and R G Payne, No. 53-S-18 (2) *The Free Piston Type of Gas Turbine Plant and Applications*, by J J McMullen and R Ramsey, No. 53-S-13 and (3) *The Development of High Output Free Piston Gas Generators*, by F M Lewis and R A Lasley, No. 53-S-34.

For basic theory of these engines see Power, Dec 1952, pp 104-105; Jan 1949, pp 79-81; Dec 1942, pp 888, 889. These gas generators feeding a single gas turbine hold out the promise of achieving high thermal efficiency of the diesel cycle, together with simplicity of turbine-shaft output. The papers report three designs of free-piston units.

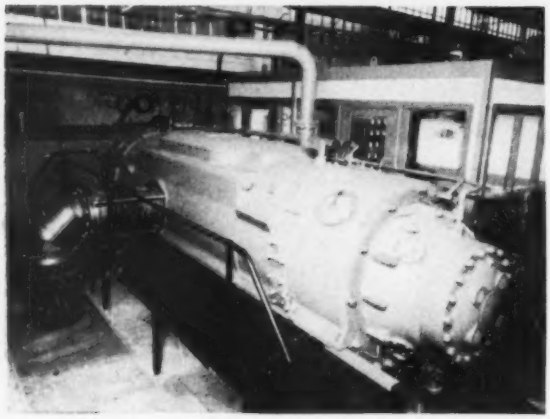
Sigma gas generators based on the Pescara patents were built in France and have been applied to electric generation, locomotive drive and ship propulsion. These models use relatively low-pressure low-temperature gas (50 psig, 945 F) discharge from the free-piston unit to run the turbine. They are built for construction economy and low maintenance cost. Air compresses on the inward stroke, and no cylinder cooling is used.

Cooper-Bessemer generator works with outward compression, Fig. 5, and cylinder cooling. To gain competitive advantage it generates 72.5-psig 1000-F gas for the turbine, Fig. 6. It is primarily a heavy-duty unit for driving natural-gas pipeline centrifugal compressors, electric generators and marine vessels where weight and space are not major considerations.

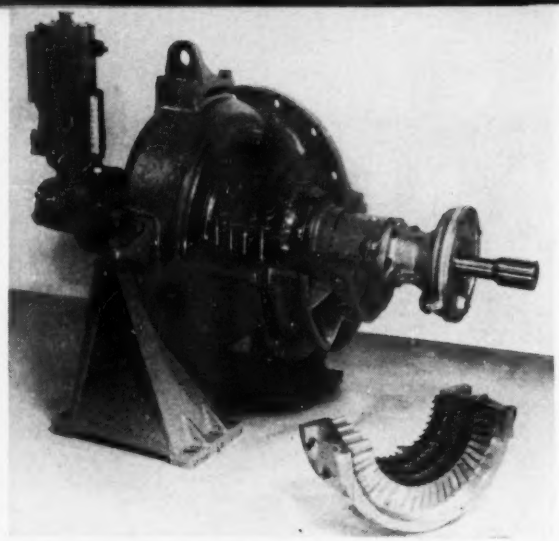
Baldwin - Lima - Hamilton generators also use outward compression and cylinder cooling, Fig. 2 and 3. Designed for lightweight applications they discharge 90-psig 1300-F gas to the turbine. As a result, the diesel cylinder runs at higher operating conditions than those of usual reciprocating engines. This gives it a higher specific power than the generators mentioned before. The BLH units are being specifically developed for Naval combat vessels where weight and space are primary considerations.

Test data on the Sigma gas generator figured at 85% turbine efficiency showed it would develop 1255 shaft hp at a maximum thermal efficiency of 32.4%.

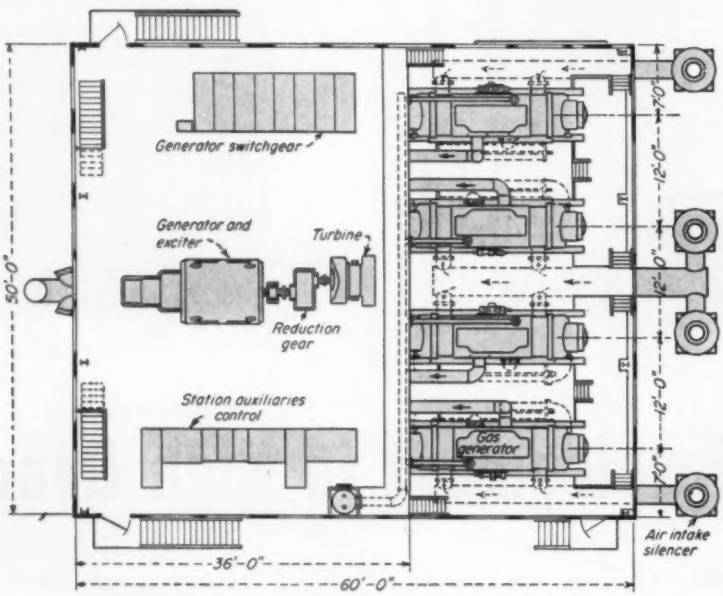
More on next page

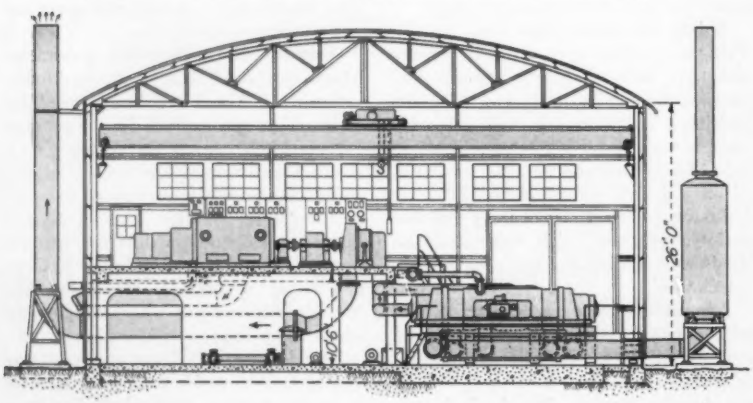


5 Cooper-Bessemer free-piston gas generator develops 1750 gas hp at speed of 555 cpm, exhausts through line at left



6 Cooper-Bessemer 5-stage reaction gas turbine delivers 1500 hp with 72.5-psig 1000-F gas, speed of 14,400 rpm





7 5000-kw electric-generating station would use four 1750-hp gas generators to feed a single gas turbine driving generator through a 4:1 speed-reducing gear

Free-Piston Plant...

Efficiency drops off with load, but assuming 85% turbine efficiency at 25% output, the over-all thermal efficiency would still be 22%. Gas temperature at about 1500 gas hp barely exceeds 1000 F. At 400 gas hp, it drops to about 540 F. Compressed air enters the diesel cylinder at 520 F at full load, and drops off to about 330 F at 200 gas hp. Piston frequency varies from about 470 cpm at 10-psig discharge pressure to slightly over 600 cpm at 55 psig.

Two gas generators (Model B) feeding one turbine make up one unit delivered by Baldwin-Lima-Hamilton to the U.S. Naval Engineering Experiment Station for testing and evaluation. From 700 hours of test operation this unit showed a net output of 1420 shaft hp corrected to 85% turbine efficiency. Maximum thermal efficiency corresponding reached 32.3%. Discharge-gas temperature varied from 1350 F at about 1750 gas hp down to about 630 F at 420 hp. Piston frequencies vary from about 1035 cpm at 90-psig exhaust to 880 cpm at 40 psig. Maximum cylinder pressures run much higher than conventional engines. From a maximum of 2200 psig at 90-psig exhaust they range down to 1460 psig at 40-psig exhaust. Expected performances for the Model A gas generator under varied conditions are shown in Fig. 9.

Rating of the Cooper-Bessemer gas-generator unit for test purposes has been taken as 1750 gas hp at 72-psig 1000-F exhaust. Thermal efficiency referred to gas hp has been confirmed at 45%. The 5-stage reaction turbine runs at a rated speed of 1500 hp with 85%

I: 10,000-Kw Electric Plant Investment

Land and improvements		$32,500
Structures		
a. Main generating building	$93,400	
b. Shop and warehouse building	22,100	
c. Office building	9,700	
d. Water well	21,300	
e. Total		146,500
Equipment		
a. Gas generators, turbines, alternators	$919,600	
b. Switching, standby generator	234,100	
c. Fan-cooled radiator equipment	74,200	
d. Piping, instruments, miscellaneous	152,100	
e. Total		1,380,000
Contingencies at 7%		109,100
Engineering, overhead, interest at 9%		150,100
Total capital investment		$1,818,200
Average unit cost		$182 per kw

II: 15,000 Hp Compressor Station Investment

Land and improvements		$32,500
Structures		
a. Main compressor building	$93,400	
b. Shop and warehouse building	22,100	
c. Office and communication building	9,700	
d. Water well	21,300	
e. Total		146,500
Equipment		
a. Gas generators, compressors	1,035,000	
b. Electric work, standby generator	70,500	
c. Fan-cooled radiator equipment	90,300	
d. Piping, instruments, miscellaneous	186,300	
e. Main gas piping	216,800	
f. Total		1,598,900
Contingencies at 7%		124,500
Engineering, overhead, interest at 9%		171,200
Total capital investment		$2,073,600
Average unit cost		$138 per bhp
Average unit cost including operator housing		$143 per bhp

...Design Depends on Job: Mechanical Drive, Electric Power, Propulsion

efficiency and a gas flow rate of 32,000 lb per hr. Performance of the complete unit for different pressures and temperatures and at part loads are shown in Fig. 8.

Two methods of unloading protect the turbine against overspeed: (1) A bypass valve in the generator exhaust line trips open to vent residual gas to atmosphere. (2) Fast fuel cutoff stops gas generation. Conservative design is aimed at continuous heavy-duty operation. Compared to heavy-duty engines of conventional type the generator-turbine unit is expected to save from 30 to 60% in weight and space.

Electric Generation. Fig. 7 shows the Cooper-Bessemer layout for a 5000-kw electric-generating plant. Four 1750-hp gas generators standing about four feet above the concrete mat foundation supply one gas turbine. The turbine drives a 5000-kw alternator through a reduction gear. The turbine nozzle arcs would be divided into sections, one gas generator feeding a section. With one generator out of service the remaining units would still be able to supply the turbine and carry load.

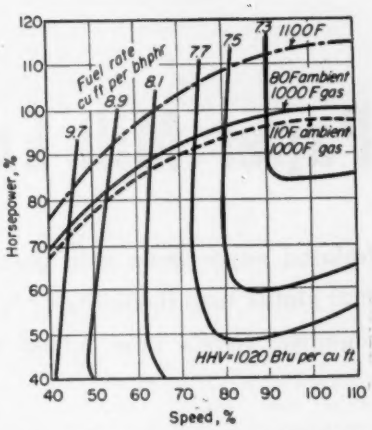
Part-load efficiencies would be expected to be relatively high. A high-pressure storage-type fuel system feeds the power cylinder through three fuel nozzles. Ultimately the power-gas generators would be expected to run as dual-fuel engines, burning natural gas, diesel oil or even heavy oils.

A single lever on each generator governs fuel quantity, timing, and bounce effect through commercial-type pneumatic and hydraulic devices. The turbine speed governor controls the generator control levers for automatic load-fuel control of the entire plant. Automatic devices shut down the units in the event of piston overstroke, turbine overspeed, excessive temperature and low lubricating-oil pressure. Plant can run automatically over the entire load range from idling to full load.

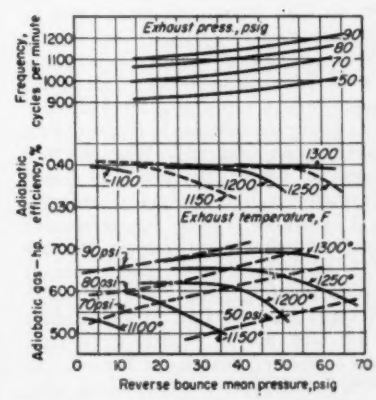
Circulating water, lubricating oil and other auxiliary pumps would have individually powered drives to achieve greater operating flexibility. The free-piston generator having a variable compression ratio can be adjusted to fuels and overstroked to maintain rated power under hot ambient conditions.

Table I shows an investment estimate for a 10,000-kw electric plant with two turbine-generators and eight free-piston gas generators.

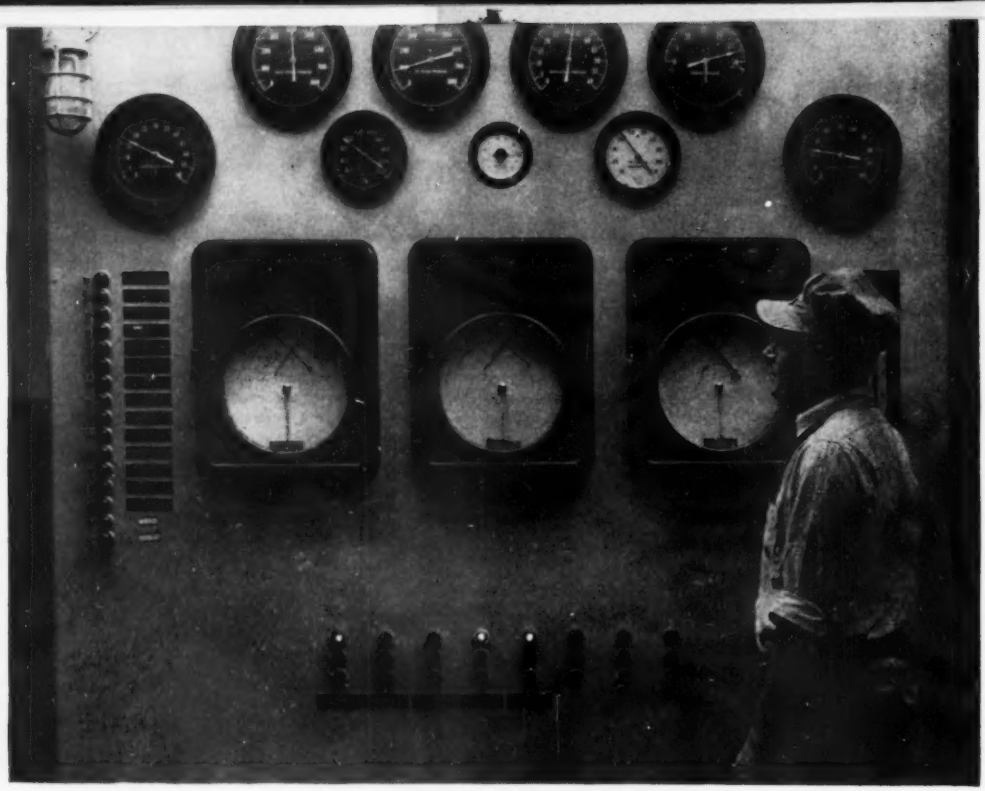
Pipeline Pumping Station. Fig. 1 shows the main elements of a 5000-hp pipeline compressor station with three generators feeding one turbine that drives a centrifugal gas compressor. Fig. 4 shows detailed views of a smaller 1500-hp booster station. Table II gives an investment estimate for a 15,000-hp compressor station with three centrifugal compressors using three of the units shown in Fig. 1. The accessories are all unitized on the basis of three gas generators to a group. All accessories, such as water and oil pumps, are manifolded and piped to serve the one group. There would be a wide choice of arrangements and capacities available from a single standardized design of gas generator at costs competitive to similar sized prime movers.



8 Free-piston engine plant maintains high part-load efficiencies easily



9 Free-piston engine performance depends on pressures and temperatures



STEAM LOADS at Nekoosa mill indicated a 6000-kw turbine generator would fit into plant cycle but with service limited to times when extraction loads were available. So compact, complete control setup was vital

Paper Mill Expands for In-Plant Steam

Isolated paper mills gain greater stability for power circuits plus higher load flexibility by tying electric-generating capacity together. Here's how added steam needs do double duty

By F H COLDWELL, *Manager, Mill Power, Nekoosa-Edwards Paper Co*

► By 1950, Nekoosa-Edwards Paper Co saw its electrical energy load for the Nekoosa and Port Edwards, Wis., plants combined reach 13,000 kw. This energy came from a blend of three hydroelectric power sources plus byproduct steam power within each mill. When the time came to expand, the necessary power program involved two major projects: (1) adequate steam for production needs at Nekoosa only for the first step (2) ample additional electric energy but so supplied that it could serve both Nekoosa and the Port Edwards mills. First step of the expansion program was a boost of facilities at Nekoosa, up 30% in pulp, from 156 to 200 tons daily, and up about 90% in paper output, from 140 to 253 tons daily.

Steam needs at Nekoosa came in for detailed study. The existing sources were nowhere near enough. They were a 110,000-lb-per-hr 475-psi pulverized-coal boiler, a 60,000-lb-per-hr chemical-recovery unit of the same design characteristics and five low-pressure boilers acting incidentally as standby for the pulverized-coal unit and mainly as a disposal unit for waste wood.

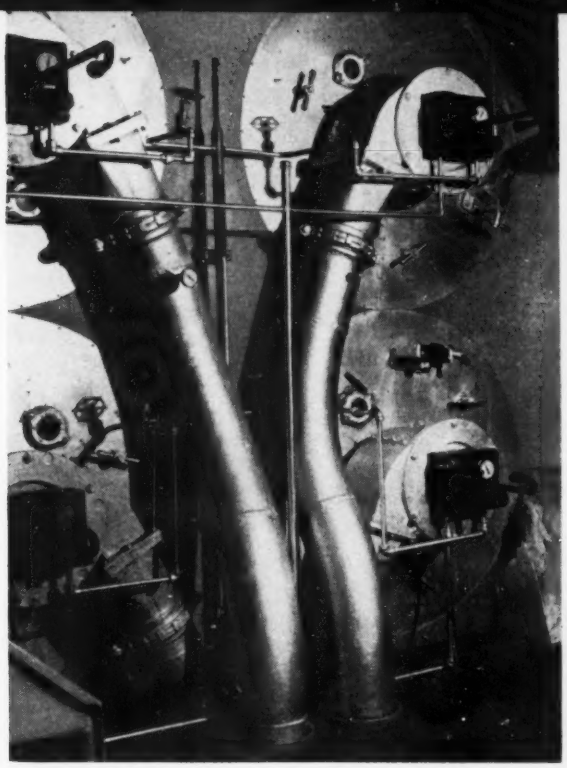
Loading diagrams for the major steam users, steam load for the maximum month, minimum average hydro generation over the past ten years, the peak expected electrical loads on the entire system, and the top capacity of the chemical recovery boiler under the new conditions went into the planning considerations.

Resulting loading indicated about 75,000-lb-per-hr of added steaming capacity would meet the requirements. But when it came down to picking a specific boiler other factors entered the picture. For example, the existing 110,000-lb-per-hr 475-psig unit carried a full load normally through most of the year. A similar size and design of boiler would permit (1) easing the loads on present facilities (2) using duplicate equipment with its attendant maintenance and operating advantages (3) scheduling some additional growth.

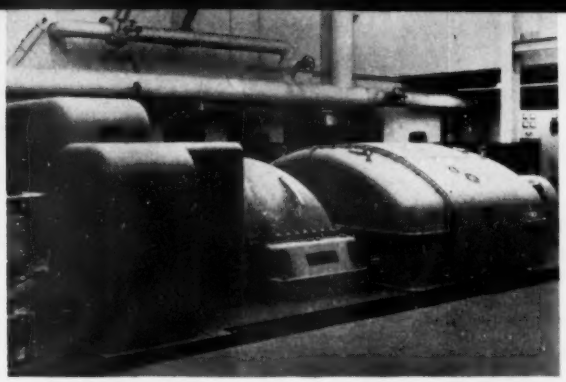
Further, this size boiler could be spotted in an area occupied by two of the five old low-pressure boilers. The remaining three, during a period of about 6 to 8 weeks in midsummer, could be pressed into full service so one of the 475-psi units could be shut down for inspection, overhaul and maintenance.

Because additional electric power was needed other pressures and temperatures than the 475-psi 700-F boiler output were investigated. A lack of condensing facilities, though, indicated the additional investment would not pay off.

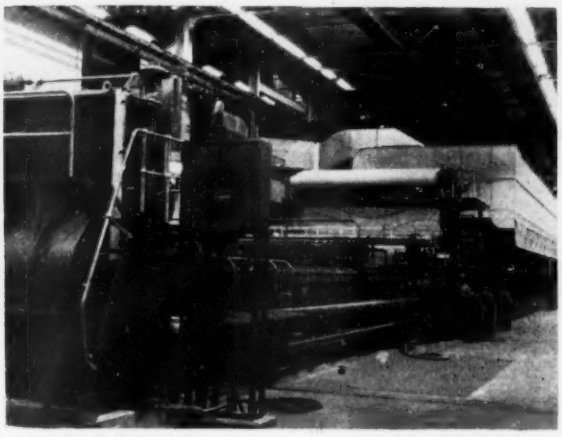
Low-cost fuel advantages, which the earlier pulverized-coal design gave, led to its selection again for the steam ex-



HEART of additional steaming capacity is a 110,000-lb-per-hr, 475-psig, coal-fired boiler, similar to the existing unit



ELECTRIC output from new turbine just meets expected needs but loading varies enough to permit a scheduled maintenance



MAJOR expansion problems involved power services to new paper machine with several banks of dryers, steam turbine drive

And Tieline Power

pansion. Latest refinements, in soot-blowing methods and burner arrangements, went into the new unit to get all possible operating and performance benefits.

Boiler-Room Accessories. Coal and ash-handling system, continuous blowdown equipment, combustion control, feedwater regulation, ventilation, coal scales and feedwater treatment were, in general, extensions of existing arrangements. The two old stoker-fired boilers, with their coal bunkers, induced-draft fans, ductwork, were pulled out, the site cleared up for the new boiler and the existing bucket elevator relocated in front of the existing stoker-fired boilers.

The remaining low-pressure units were furnished with a small coal silo and the existing bucket elevator adapted for use with this silo. A further adaptation transferred coal from the old bucket elevator to new bunkers supplying the two large-capacity pulverized-coal boilers. This introduced a definite flexibility in coal handling since it gave two ways of getting coal from railroad car to main coal bunkers. With it we could handle maintenance on any of the coal-hoisting equipment at any time and it certainly assured continuous operation.

Water Supply. The plant deaerator and condensate-return system proved inadequate under the existing plant. It held only about 3½ minutes of storage feedwater so it was intolerable under the expanded setup. Winter-load conditions in the Nekoosa plant, according to our studies, meant a supply of 300,000 lb per hr of steam. So we selected a new deaerating heater and storage tank. The deaerator can handle up to 400,000 lb per hr and the water-storage tank holds 75,000 lb, or about 15 minutes supply under winter-load conditions.

For much the same reason we added a new boiler feed pump, steam-turbine-driven. It supplies, in combination with trapped returns from process, a continuous blowdown system, and other waste steam, just about enough exhaust steam to meet feedwater heating requirements. Any additional steam that should happen to be needed comes from the 30-psi process-steam system through a reducing valve. One of the older, smaller feedwater pumps can carry the plant load during most of the summer. Two in parallel can, if need be, handle the winter-season load. This always leaves one or more pumps idle allowing time for maintenance and stand-by.

Turbine Equipment. When it came around to picking turbine size we fell back on our steam loading diagrams. These diagrams showed minimum steam requirements over the calendar year, the maximum available steam from wood refuse (which, of course, reduces by-product power supplied from turbine extraction) minimum hydro generation for the past ten years, no steam flow to paper machine dryers, but full power to keep the machines running, peak electrical loads on the full system, both Nekoosa and Port Edwards mills. Then we superimposed the new expansion paper machine and pulp requirements to determine total electrical needs.

Under the worst conditions, we felt 6400 kw was needed for the additional expansion load. An 0.8-pf 6000-kw turbine-generator with extraction at 30 psi would just meet this load. We recognized this size affords no allowance for future growth. Yet river-flow conditions vary enough so we could plan maintenance and overhaul enough ahead to keep turbine output at rating even in low-water periods.

Our load studies further indicated condensing power was needed only on an average of five months a year. Dur-

PRINCIPAL POWER-PLANT EQUIPMENT IN EXPANSION PROGRAM

Nekoosa-Edwards Paper Co, Nekoosa, Wis.

STEAM-GENERATING EQUIPMENT:

Boiler, 1 ..... Combustion Engrg-Superheater, Inc
110,000 lb per hr continuous, 125,000 lb per hr for 2 hr—700 TT, 475 psig, 2808-sq-ft waterwalls, 9104-sq-ft boiler surface, 9000-cu-ft furnace volume
Air preheater, 1 ..... Combustion Engrg-Superheater, Inc
Tubular 2 sections, 18,500-sq-ft heating surface
Pulverizers, 2 ..... Combustion Engrg-Superheater, Inc
4 burners, 11,000 lb per hr, Midwestern coal
Induced-draft fan, 1 ..... American Blower Corp
83,500 cfm at 11.8 in. wg, 375 F, 860 rpm, outlet damper
Forced-draft fan, 1 ..... American Blower Corp
43,500 cfm at 9.5 in. wg, 100 F, 1170 rpm, inlet vane damper
Magnetic coupling for i-d fan ..... Electric Machinery Mfg Co
Pulverizer and fan motors ..... Electric Machinery Mfg Co
Dust collector, 1 ..... Western Precipitation Corp
Soot blowers ..... Diamond Power Specialty Corp
2 retractable in-screen tubes, 2 retractable sidewall blowers, 10 stationary
Water columns ..... Diamond Power Specialty Corp
Safety and miscellaneous valves ..... Manning, Maxwell & Moore, Inc; Edward Valves, Inc; Crane Co
Coal-handling equipment ..... Stephens-Adamson Mfg Co
Redler vertical and horizontal conveyor, reciprocating feeder, crusher—Syntron vibrator
Car shaker, 1 ..... National Conveyor & Supply Co
Combustion control, steam meters, etc. ..... Bailey Meter Co

POWER-GENERATING EQUIPMENT:

Turbine-generator, 1 ..... Elliott Co
6000 kw, 0.8 pf, 3600 rpm, 400 psi, 700 F, 2300 v delta, 30-psi, extraction pressure
Condenser, 1 ..... Worthington Corp
4500 sq ft horizontal, 2-pass, divided waterbox
Circulating pumps, 2 ..... Worthington Corp
2500 gpm, double suction, centrifugal, 1200 rpm
Condensate pumps, 2 ..... Worthington Corp
150 gpm, center suction, centrifugal, 1200 rpm
Air ejectors, 2, 108 sq ft ..... Worthington Corp

FEEDWATER EQUIPMENT:

Feedwater heater, 1 ..... Cochrane Corp
Spray—tray type, 400,000 lb per hr
Boiler feed pump, 1 ..... Ingersoll-Rand Co
375,500 lb per hr, 592-psig discharge, 3550 rpm
Boiler-feed-pump turbine, 1 ..... Elliott Co
3550 rpm, 360 hp, 400 psi, 700 F inlet, 5 psi BP
Water-treatment tanks, 3 ..... Infilco, Inc
Split stream, hydrogen zeolite, 450-gpm maximum rate
Chemical feed pumps ..... Dearborn Chemical Co

MISCELLANEOUS EQUIPMENT:

Liquid-level equipment ..... Fisher Governor Co
Reducing valves ..... Cochrane Corp
Feedwater controls ..... Bailey Meter Co
Desuperheaters, 3 ..... Swartwout Co
Makeup pumps, 2 ..... Goulds Pumps, Inc
350 gpm, 150-ft head
Turbine-room crane ..... Industrial Equipment Co
15 ton, 1 hook
Ventilating equipment ..... American Blower Corp
Coal scales, 2 ..... Stock Equipment Co
Oil-filtration system ..... Bowser, Inc
Paper-machine turbine ..... Worthington Corp
Variable speed to 500/4500 rpm, 1000 hp, 400 psi—700 TT, 30-psig backpressure, multistage, multi-valve, direct connect to 26x15½ in. double helical speed-reducing gear, 3940/500 rpm, Woodward PH 748 governor

ELECTRICAL EQUIPMENT:

Switchgear ..... Westinghouse Elec Corp
15 kv, 1200 amp, 500-mva interrupting capacity
Switchgear ..... Westinghouse Elec Corp
5 kv, 200 amp, 250-kva interrupting capacity
Motor starters, 2400 v, limit ampere control ..... General Electric Co
Motor starters, 480 v ..... Cutler-Hammer, Inc
Unitrol, fused combination starters
Outdoor transformer ..... Westinghouse Electric Corp
750 kva, 15 kv/2400 v, 3 phase, 60 cycle
Unit substations, 2 ..... General Electric Co
1500 kva, 2400/480 v with three AL-250 800-1200 amp secondary breakers
Unit substations, 2 ..... General Electric Co
2000 kva, 2400/480 v with two AL-2-50, 1200 amp, and one AL-2-75 secondary breakers
Bus duct, 2400 v ..... Westinghouse Electric Corp
15 kv, 2000 amp duct
Bus duct, 480 v ..... Bull Dog Electric Co
LoX duct in 800-amp and 1200-amp sizes
Cable trays, 6, 12 and 18 in. ..... T J Cope, Inc
Station-control battery ..... Electric Storage Battery Co
Manchex, DME-17, 125 v, 60 cell, General Electric Phano-charger 121½ amp

CONSULTING ENGINEERS ..... Chas T Main, Inc

PAPER MILL EXPANDS *continued*

ing the rest of the time the condenser runs at minimum load. The average condenser load, in fact, amounts to only 2000 kw. What's more, our loading plans call for turbine operation only when loads supplied at the 30-psi-extraction level are available. So we picked a condenser to meet capacity under a 4-in. vacuum at full load. Two half-capacity circulating-water pumps and two half-capacity condensate pumps complete the major condenser auxiliaries. These sizes, we felt, would save power under high-extraction conditions.

Electrical Equipment. While we definitely tied turbine size to our Nekoosa plant's steam needs we still had the problem of fitting this 6000-kw source of electric energy into a 2-plant system, which up to then totaled 13,000 kw. We started with an intensive review of electrical connections between the plants.

They tie together through a 15-kw system originating at the Centralia, Wis. 3600-kw hydro station and linking up with hydro and steam plants of Port Edwards and Nekoosa. The new 6000-kw unit exceeded the existing interrupting capacity at most of these locations, and particularly at Nekoosa. So here again a complete revision took place.

A new outdoor 7500-kva 3-phase transformer went in between the 15-kv line and the turbine room. We split the existing 480-v distribution bus to add safety to the older switchgear and put in a new 2000-kva, 3-phase, 15,000- to 480-v transformer. Then 15-kv metalclad air-break switchgear were supplied for the new transformers as well as for the older 15-kv to 480-v and 15-kv to 2300-v transformers. All were rated at 500-mva interrupting capacity, which is ample for a long time to come.

A new 2300-v distribution center in the turbine room supplies the boiler room, and the new paper-machine capacity. It ties back through the 7500-kva transformers in the old system. This feed arrangement was considered to add stability to the system, of particular importance to the new paper machine in any plant difficulties.

Power reaches this new paper machine at both 2300 and 480 v. All paper-machine motors over 200 hp operate at 2300 v, and smaller sizes run at 480 v. Boiler room has a 2000-kva, 2300- to 480-v transformer load center. Complete metalclad motor starters operate under remote controls installed in the boiler panelboard.

Two 1500-kva, 2300- to 480-v transformer load centers serve the 480-v motors in the paper machine and stock preparation rooms. All motor starters are the latest metalclad type. All equipment is housed in separate rooms with space enough for expansion of circuits.

STEEL DRUMS carry by far the major share of industrial lubricants entering the average plant. Careless handling or storage can completely ruin them and their contents

Here Are Storage and Handling...

POINTERS ON LUBES*

► MODERN OILS AND GREASES for lubricating services are refined and manufactured to meet rigid standards. Many oils carry special additives to equip them with precise properties for particular duties. Careless or even haphazard handling and storage at your own plant can destroy the very values you may have paid a premium to get.

Problems. For example, exposure to abnormal temperatures or contamination from moisture or dirt—two strong possibilities—can bring on leakage or produce deterioration that destroys a lubricant's suitability. We'll see why later. Of course, careless handling of the containers themselves may result in dents and split seams that take their toll in direct loss. Here are some simple rules for storage and handling.

Abnormal Temperature. Both oils and greases experience considerable change under temperature variations. Their effectiveness as lubricants is reduced by hot locations. These make heavy-bodied oils thinner, tend to evaporate the required moisture content of (1) soluble cutting oils, leaving behind a jelly-like mass (2) certain greases where oil separates out from the soap.

Cold areas, on the other hand, make lubricating oils and greases more difficult to handle. The oils flow more slowly, and the greases become stiffer. Oils containing fatty materials congeal them out of solution under low-temperature conditions. In addition, soluble oils, cold enough to freeze their moisture content, prove useless.

Somewhat along the lines of temperature effect is spoilage in long storage. Soluble cutting oils suffer most from this cause through a loss of moisture. But preventing this loss is more a problem of stock control than of storage or handling.

Contamination. An improperly protected lubricant supply is almost certain to experience dust and dirt contamination. No plant man worthy of the name needs to have pointed out to him the dangers of dirt in lubricating oils and greases.

Moisture contamination is a major problem, too. Oils are more likely to be contaminated than greases. Some oils are designed to function as a lubricating emulsion in the presence of moisture, or even small amounts of water, but water contamination during storage can render them useless for later service. This holds true for most steam-cylinder oils and similar ones meant for duties like lubricating the bearings of the wet ends of paper machines. Nonsoluble cutting oils and heat-treating oils suffer complete destruction if contaminated by appreciable quantites of water.

Still another form of contamination develops. This is the introduction or unwanted mixing of different oils when dispensing them within your plant. It stands to reason oils of different qualities when blended produce a third, entirely new oil. You must take certain precautions, and then exercise definite care to keep original oils effective.

(More on next page)

*Abstracted from *Technical Bulletin on Handling, Storing* and *Dispensing Industrial Lubricants, by Socony-Vacuum Oil Co, Inc.*

Draw on these easy-to-use tips based on in-plant...

STORAGE

Outdoor storage is never too good. Brand markings and labels wash off or become obliterated under weathering. Future dispensing is needlessly endangered and other lubricant contamination becomes more possible. Temperature changes from season to season can produce enough expansion and contraction stresses over a period of time to develop leaks in the container seams.

Moisture contamination is a potent threat with outdoor storage. Rain water collects readily inside the chime top, see first sketch. It is gradually sucked past the bung by the drum's breathing during alternate hot-and-cold periods.

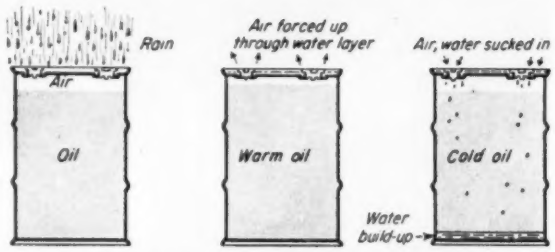
If you must store outdoors, spread tarpaulins over the drums or erect a temporary shelter. Then if mechanical means are available, turn each drum over so the bung end is down. If you can't do this, lay the drums on their sides, and line them up so the bungs make up a horizontal line across the drums' middle.

Actually, there are four major recommendations that apply to outdoor storage: (1) Provide at least temporary shelter against the weather. (2) Place drums so they cannot breathe through the bungs. (3) Make sure bungs are made tight if you are going to move drums. (4) Before opening, dry and wipe bungs thoroughly as well as the surrounding surfaces.

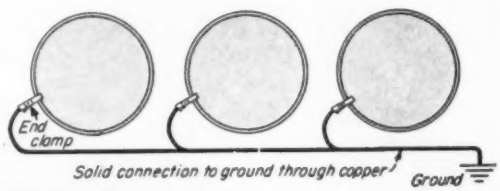
An oil house is the ideal and logical place to store and dispense oils and greases of all sorts, as well as to carry out the cleaning of dispensing equipment. Size varies with the individual plant. Some plants require only a single oil house or even a part of a full-package warehouse. But no matter what its size, every plant needs an oil house of sorts.

Experience indicates the oil house should be closed to all but authorized personnel. Locate it as centrally as possible, yet in an area free from possible process contamination, as from cement dusts, chemical fumes, coke dust and similar byproduct wastes.

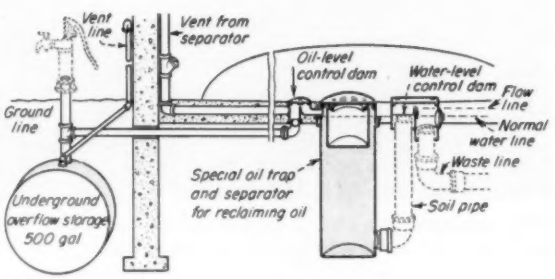
Storage takes many forms. Mechanical aids, in sketch below, are one. You can buy the storage racks commercially. Take steps to prevent any harm to personnel from toppling or rolling drums, barrels and containers. Further, it's smart to see that the drums are grounded electrically, second sketch, especially with flammable volatile solvents.



OUTDOOR STORAGE, never desirable, makes drum contents an easy prey to contamination by an outside moisture like rain



ELECTRICALLY GROUNDED connections on drums, especially if they hold volatile solvents, is a smart measure for safety

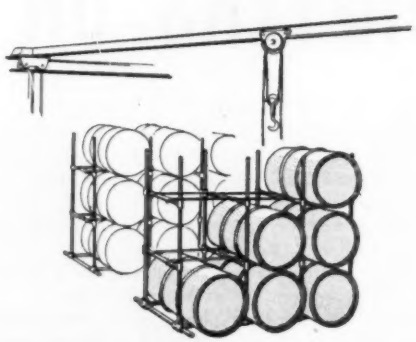


OIL HOUSE should be set up so all its facilities are permanently installed, and ample waste drains supplied as best storage bet

HANDLING

Handling the containers, when lubricants are both coming into storage and being dispensed, goes best with certain mechanical aids. They can be anything from the simple hand truck, sketch top of facing page, to chain falls and trolleys, sketch at right, or electrically operated elevators or lift trucks. Some companies, however, just roll tht drums from delivery point to storage.

By far the greatest volume of industrial lubricants arrives in drums shipped by railroad or motor truck. The load consists mostly of a single tier of drums, each standing on end. Unloading platforms, level with railway car or truck, make it easier to handle the drums and reduce possible damage risks to containers. Wooden or metal ramps serve well where there are no unloading platforms. Slide the drums endwise



MECHANICAL AIDS like chain falls and trolleys make handling of drums into and out of storage comparatively easy

...surveys to help bring your lube-handling problems under control

to the ground. Never drop an oil drum from a truck or railway car onto a cushion of discarded automobile tires.

Major transporting activity of oil drums should be confined to trips from unloading area to the oil house. This method involves the handling of bulk quantities only. It entails stacking and storing, plus dispensing and disposal of waste oils and empty containers.

MANUAL LABOR, particularly if helped by hand trucks, can do effective job in the average small-to-medium-sized plant

DISPENSING

Hand oilcans, large dispensing safety cans, oil wagons, grease guns, lubricating cars and sump pumps comprise the more important dispensing and transporting equipment for grease and oil.

Clean this class of equipment regularly. But don't limit your cleaning to mere wiping with solvent-soaked rags. Instead, use generous quantities of solvent for both cleaning and rinsing. Baths of safety solvent (flash above 100 F) meet the usual safety regulations where ventilation is adequate and correct covers are provided. First sketch at right shows a good arrangement with two baths, one for cleaning and one for rinsing.

Actual transfer of oil from container to dispenser may entail nothing more than a hand-operated drum pump, shown in sketch, driven into the bung of the oil drum. Such a pump is a positive-delivery type capable of supplying measured oil quantities.

You can get pumps, however, with spring-action closable returns, and in air-operated or electrically driven designs. Drum faucets also prove efficient and economical transfer devices. They come in different sizes for fast, slow oils.

Because of its consistency, grease presents some special problems in transfer to dispensing equipment. A good metal paddle does a fine job particularly for heavier greases.

But the major problem comes from dirt and other contaminants that land on the surface of open drums and exposed grease. Take every care to keep drums closed when not in use. Extra precautions against stray dirt should apply while the grease is being removed.

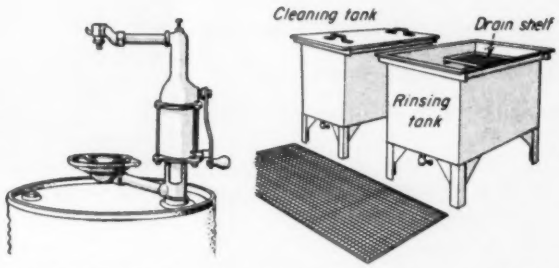
Air-operated pumps do a fairly good job in pulling grease out of drums without exposure to the air. But you cannot always count on them for greases harder than No. 2 or 3 consistency.

Sump Pumps. Used oil has to be periodically removed from reservoirs and sumps. The sumps can be anything from the small reservoirs for textile-spindle and machine-tool-spindle housings to large systems like hydraulic machines.

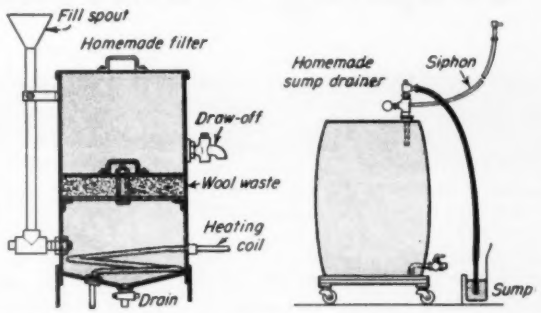
Sump drainers can be homemade. One such example is shown in second sketch, right figure. It employs a heavy steel drum, a siphon, and compressed air to draw from sump.

Often you'll find it desirable to purify certain types of lubricating oils for reuse. Extent of the purifying equipment depends entirely on how much of a saving it gives you. A very simple arrangement is pictured in the second sketch, left figure. If your wants are greater, it may pay to set up a purifying section within your oil house.

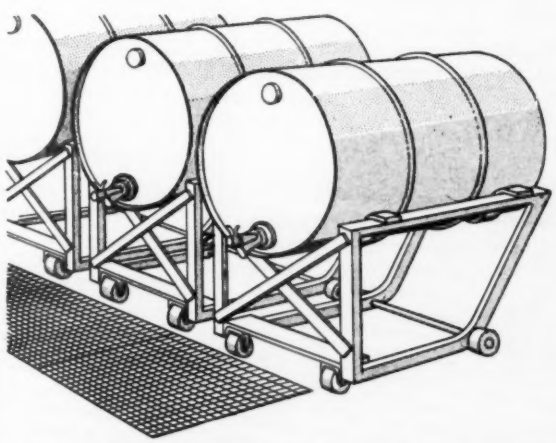
All in all, though, lube oil-and-grease handling is a relatively simple operation that gives little trouble if it is planned and controlled properly.



HAND-OPERATED drum pump, *left,* is a good dispenser of lubes. keep it and other dispensers clean by solvent baths, *right*



SPENT OILS can be reclaimed in simple filter, *left,* or pulled from sump by compressed air siphon, *right,* for disposal



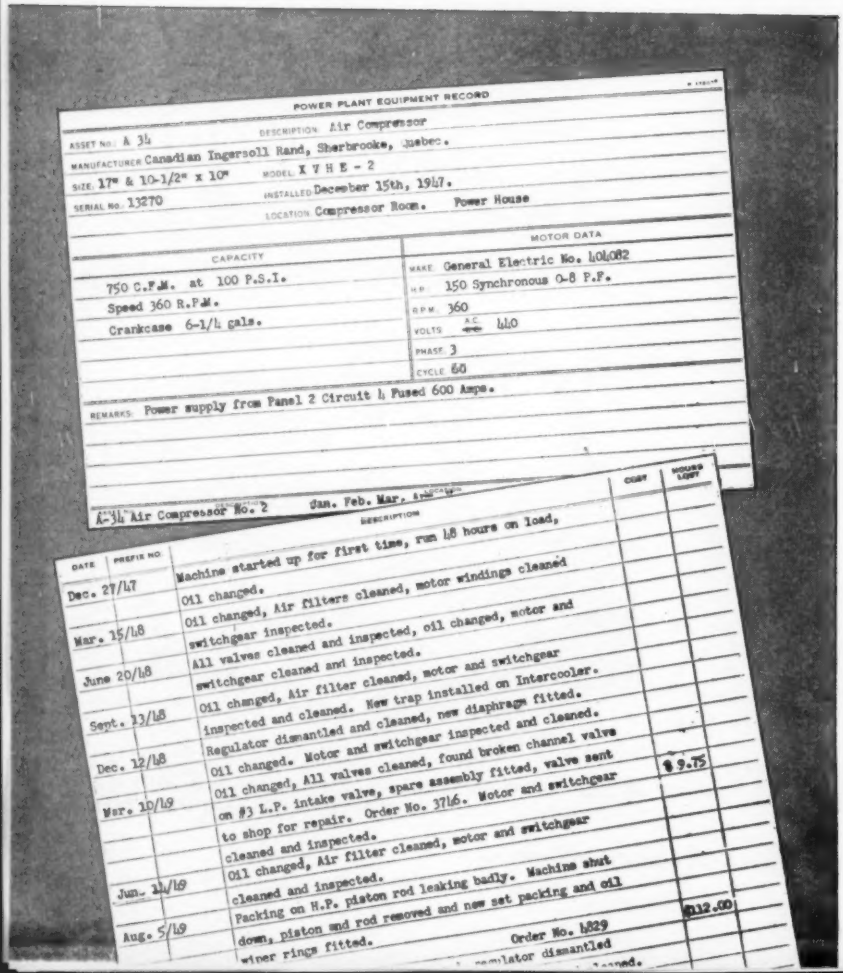
AS DISPENSING METHOD that is both quick and easy, use rocker-type racks and a set of drum faucets, as is shown here

Just let maintenance lag and operation will suffer badly. On the other hand, poor plant operation makes maintenance costs climb sky high. Here are some practical steps you can take to mesh the two together

By F A HINCHCLIFFE, *Chief Engineer*
Northern Electric Co, Ltd

PAPER WORK, like it or not, plays a big part in setting up an orderly plant program for maintenance and operation, says Author Hinchcliffe, from first-hand experience

Coupling Maintenance With Operation



POWER PLANT EQUIPMENT RECORD

ASSET No. A 34 DESCRIPTION Air Compressor
MANUFACTURER Canadian Ingersoll Rand, Sherbrooke, Quebec.
SIZE 17" & 10-1/2" x 10" MODEL X V H E - 2
SERIAL No. 13270 INSTALLED December 15th, 1947.
LOCATION Compressor Room. Power House

CAPACITY
750 C.F.M. at 100 P.S.I.
Speed 360 R.P.M.
Crankcase 6-1/4 gals.

MOTOR DATA
MAKE General Electric No. 404082
H.P. 150 Synchronous 0-8 P.F.
R.P.M. 360
VOLTS A.C. 440
PHASE 3
CYCLE 60

REMARKS: Power supply from Panel 2 Circuit 4 Fused 600 Amps.

A-34 Air Compressor No. 2 Jan. Feb. Mar. Apr.

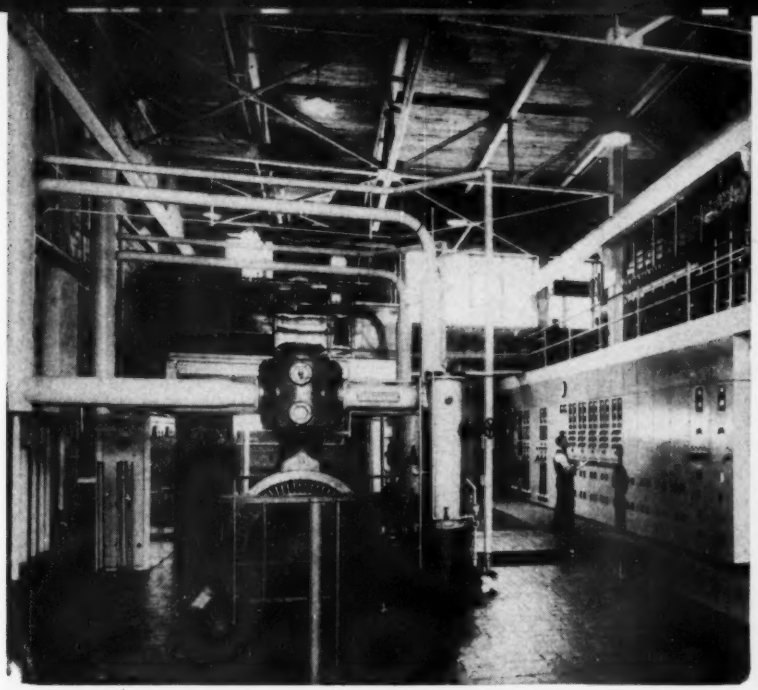
DATE	PREFIX NO.	DESCRIPTION	COST	HOURS LOST
Dec. 27/47		Machine started up for first time, run 48 hours on load,		
Mar. 15/48		Oil changed.		
June 20/48		Oil changed, Air filters cleaned, motor windings cleaned switchgear inspected.		
Sept. 23/48		All valves cleaned and inspected, oil changed, motor and switchgear cleaned and inspected.		
Dec. 12/48		Oil changed, Air filter cleaned, motor and switchgear inspected and cleaned. New trap installed on Intercooler.		
Mar. 10/49		Regulator dismantled and cleaned, new diaphragm fitted. Oil changed. Motor and switchgear inspected and cleaned. Oil changed, All valves cleaned, found broken channel valve on #3 L.P. intake valve, spare assembly fitted, valve sent to shop for repair. Order No. 3716. Motor and switchgear cleaned and inspected.	$ 9.75	
Jun. 21/49		Oil changed, Air filter cleaned, motor and switchgear cleaned and inspected.		
Aug. 5/49		Packing on H.P. piston rod leaking badly. Machine shut down, piston and rod removed and new set packing and oil wiper rings fitted. Order No. 4829	$12.00	
		Regulator dismantled		

KARDEX SYSTEM proves heart of controlled maintenance plan. Face of card, top, gives individual equipment data plus scheduled maintenance dates. Colored tab over month indicates electrical or mechanical servicing. Back of each card, *lower half*, gives history, condensed maintenance remarks appearing on Daily Log Sheet, plus costs

► THE PART maintenance plays in operation, and vice versa, opens the same argument as the chicken and the egg: Which comes first? Whether you're building a new power plant or have been operating one for years, it's still true that proper operating procedures do reduce periodic inspections, adjustments and repairs required to keep equipment in good order.

The Lachine plant of Northern Electric Co, Ltd manufactures wire and cable varying in sizes from No. 44 B&S to the largest power cables in use. This output requires thousands of pounds of copper each week, and in processing this raw copper, the power services prove most important.

Further, with production on incentive basis, the supply of electrical power, steam, compressed air, process fuel oil



HOUSEKEEPING, held within bounds, is essential to employe morale. It helps promote vital pride in keeping equipment tiptop; exercising care in its correct operation

ROUTINE checks, like these insulation tests, must always be a part of program

Gives Ideal Plant Team

and cooling water have to be as free of interruptions as possible. Along these lines, we have developed a plan of preventive maintenance, that proves most effective. But, in addition, we've developed a program based on three vital factors: morale, good housekeeping, operating instructions.

Morale. The operating chief and his supervisory staff must inspire loyalty in the operating crew, and get good performance from them by leadership, fairness and impartiality. Credit and encouragement should be given when due, and proper correction methods used when necessary.

Good housekeeping standards must be set by the department head. He should also make a fair division of the work so each operating shift is responsible for definite pieces of equipment or areas.

An orderly place to work encourages clear thinking, promotes safety, and reveals defects and irregularities normally hidden from view in untidy plants. Automatic control and mechanical labor-saving devices release men from manual operations so the housekeeping standard is held at a level where it promotes pride.

Operating Instructions. With power-plant equipment more and more complex, all instructions should be in written form. Let them be available to the entire staff, so each member knows how his duties relate to the activities of others. The plant then operates in a uniform and efficient manner on all shifts.

Here is the makeup of the manual at Northern Electric. We prepared it in loose-leaf form to allow for additions and revisions from time to time. Then we divided it into various sections, each indexed and covering these items:

1. Regulations of the company in general, and the powerhouse in particular.

2. Fire prevention and fire-fighting. This section outlines the various extinguisher types throughout the plant, gives their location, application and method of operation. The section also deals with fire pumps, gives a list of the plant fire brigade, and other items of this type.

3. Electrical. This section explains operation of substation equipment, including high- and low-tension switchgear. It deals with outside power failures, use of mercury arc rectifiers, and motor-generator sets.

4. Air-compressor installation. Instruction is provided covering starting, running adjustments, and repairs on the unit. Also, operation of synchronous motors driving the compressor.

5. Boilers and their auxiliaries. Lighting up, flame failures, periodic checks on all safety devices, feed pumps, water-level regulators, fuel pumps, automatic combustion-control equipment, boiler-water chemical treatment system, and weekly test runs on all standby equipment. Also the procedure in complete shutdown, both planned and emergency.

6. Process fuel-pumping equipment. Included are operation and servicing instructions.

7. Lubricants and packings. A complete list of all packings and lubricants used in the powerhouse, showing the manufacturers' general recommendations, where used, and sizes required for each application.

8. Receiving and unloading supplies of fuel and other commodities. The various types of tank cars likely to be encountered, heating and pumping fuel oil, information on valve locations and storage tanks.

9. Housekeeping. Responsibilities of each shift for maintaining the standard of housekeeping, and the frequency of all related duties.

10. Plant drawings. Small reproductions of plant drawings, showing locations of all power and lighting mains, power panels, water, gas, oil, steam and

FREQUENT alignment surveys, with proper equipment like this dial indicator, assure trouble-free service from all pumps

CALIBRATION of meters, instruments, on regular basis makes certain day-to-day records carry true picture of conditions

Fundamentals of Trouble-Free Operation and

compressed-air mains. Also, sprinkler loops, fire-hose connections, drains and sewers, fire-extinguisher locations and fire-zone limits, and the color-coding system on all pipelines.

New employes get complete instructions on location of all items referred to in the manual. This manual remains in the shift engineer's desk where all have access to it at any time.

A Daily Log Sheet supplies all essential information and, when used in conjunction with the graphic records provided by metering, it gives an opportunity to spot unusual operating conditions immediately.

Individual boiler-efficiency checks are made each day, thus providing an indication of expected day-by-day performance of the equipment under varying load conditions. Any deviation from normal leads to an inspection and check of such items as the oil meter, steam flowmeter, automatic-combustion control and drives, and other related mechanism.

Daily meter records of the amount of raw water for makeup provide a ratio between condensate returned and steam load to be set up. This reveals the existence of inoperative condensate-return pumps, and other sources of condensate loss.

Adequate metering and automatic control, properly serviced and maintained, has been an important factor in the smooth performance of powerhouse equipment, thus helping to keep factory production at a high level.

Maintenance. Now for our second source of strength—maintenance. With operation running smoothly, we needed equal planning to clean, inspect, adjust and repair our equipment at regular intervals, timed so production was not affected. Each plant has its own particular problems, but with the reliability built into today's equipment, we felt we could work out a carefully planned schedule to produce the desired result.

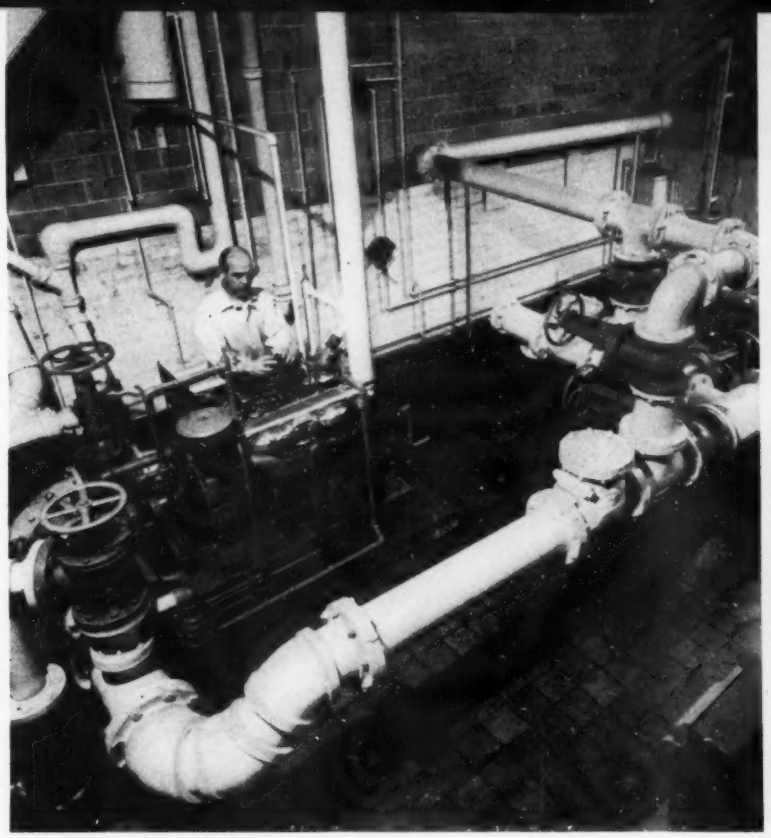
Here's the way we handled the problem in our power plant:

We prepared mimeographed survey sheets, covering steam, electrical, and compressed-air equipment, made out in question-and-answer form to reduce the amount of writing. They went to shift engineers, maintenance electricians, steam fitters and repair men. They then ran the survey, covering a few items per shift along with their regular duties.

In this manner, we got together the required information. What's more, the survey had a certain educational value to those making it, judging from the many interesting questions on the completed sheets.

As each complete unit survey came in we set up a filing folder bearing the identification number of the equipment and its popular-name description. Thus, a certain file might be called *Power-Plant Information, A 46, Boiler Feed Pump.* Into this folder went the survey sheet and all available information on the equipment, including maintenance instructions, technical data, drawings, wiring diagrams and parts lists. At the same time, we contacted the manufacturer for any information that might be missing.

As soon as the information file for a given unit was complete, the foremen and supervisors responsible for maintenance met with us in a round-table discussion. We drew up a check chart for each unit on what should be done and when, based on manufacturers' recommendations, our own experience, and



EMERGENCY EQUIPMENT, like these fire pumps, standby devices must be turned over, checked regularly, to be ready for quick service when the need develops

SPECIAL PROCESS needs, such as dc power, require special equipment as well as care

Low-Cost Maintenance Have Their Beginning in Good Supervision

plant conditions. These charts stress safety precautions, give information on doing the work, and indicate references where more detail, if required, can be found.

When a new employe takes on a maintenance job, his supervisor shows him the equipment, gives instructions from the check chart, explains and demonstrates them, if necessary. The new man then works for a while under supervision. Usually when the next service period arrives, he can do the job himself, using the check chart as a reference.

As each employe completes his section of the work, he signs for it. When completed, the chart is routed to the shift engineer, who enters on the Daily Log Sheet a condensed report of work accomplished. In this way, each shift knows what other shifts have done. The check chart then goes to the chief's office, where it is filed in the corresponding unit information file as a detailed record.

To have a ready reference on all equipment, we set up a Kardex system (sample on p 92) with each face card showing the equipment description, location, manufacturer's nameplate data, packing and lubricant recommendations (when used), electrical equipment data, and location of power-supply panels, fusing, etc. On the face card's lower edge, we typed the months of the year, and used sliding transparent tabs of different colors to show the month and class of service due. Red tabs are used for electrical, blue for mechanical.

Cards also show the spare-parts supply, their location, and minimum stock carried. At the back of each equipment card is a history card, p 92, carrying condensed maintenance remarks as they appear on the Daily Log Sheet, plus costs, which are available from the accounting department.

Charges for all maintenance in the powerhouse are made to the following accounts: steam, electric power, compressed air, water. Charging methods are by shop orders or services orders. For repairs and adjustments by the operating staff, the only direct charge is for material requisitioned against the corresponding account number. Service orders cover all labor and material for the work of one man for not more than two hours. They are issued to cover a period of one month on each of the various accounts. Shop orders include all work and material for specific jobs not covered by the foregoing. In practice, this simple system works well. A daily reference to the Kardex system indicates maintenance work due in the month in which we are operating.

Selection of the proper check chart gives a detailed description of how the job should be done, while reference to the previous chart shows the result of the last inspection, and the employe who did the work.

We modify these charts from time to time, as conditions change or as we develop improved maintenance techniques. Information file folder for each unit contains all available data for operating, maintaining and ordering. As part of our educational effort to our employes we make copies of all manufacturers' instructions and reprints of technical papers appearing in engineering journals readily available.

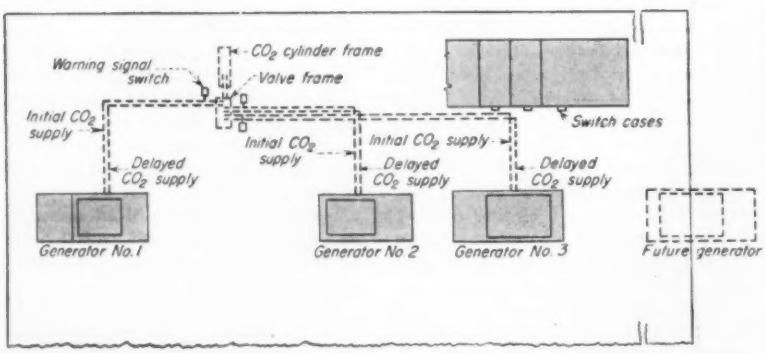
It all pays off in dollars and cents by reducing operating costs, and increasing production, because the equipment is always found to be in good working order when it is required.

FIVE 75-LB CYLINDERS of CO_2 supply extinguishing agent. Frame on right comprises the valves, piping, manual actuators

CONTROL PANEL gives alarm when smoke is detected. Operator breaks glass cover, throws switch to actuate the CO_2 system

Automatic System for Fire Protection

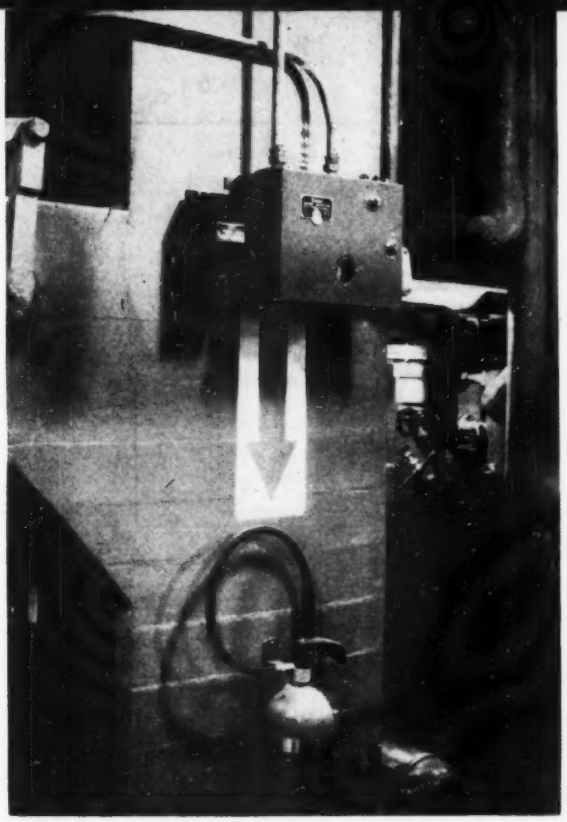
To minimize the danger of fire damage to costly generators, Pfizer's Groton plant put in automatic smoke warning and fast CO_2 extinguishing systems. Here are details of equipment to sound the alarm, and put a speedy end to generator fires



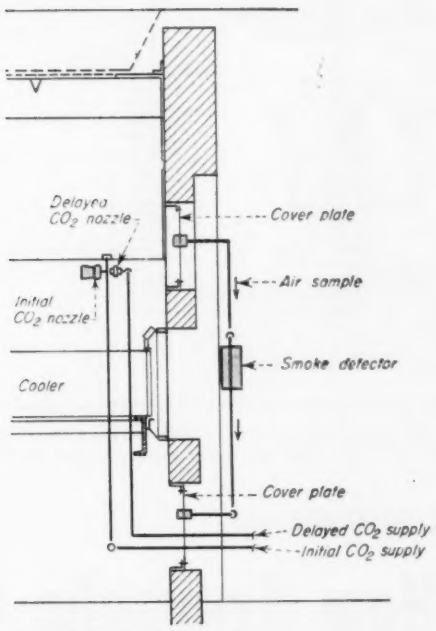
CO_2 SYSTEM operates when switch is pulled. Two cylinders immediately dump gas into cooling system of the generator in trouble. The other three discharge gradually

► When Charles Pfizer & Co, Inc installed three turbine-generators in their Groton, Conn. plant, protecting them against fire damage was a major problem. These units—two of 2500-kw capacity and one of 6000-kw—supply most of the power needs of this plant, the second largest fronting on the Thames River.

Any emergency curtailment of electricity would force slowing-down or closing operations, and could cause untold loss to work-in-process and stored inventory. So the company wanted a protective system that would give immediate warning of a generator fire, and extinguishing equipment that would put



PHOTOELECTRIC CELL continuously tests generator cooling air. Smoke triggers audible and visual alarms on the control panel



CONTINUOUS SAMPLES drawn from exhaust air return to the generator after being analyzed

Guards This Generator Installation

out fire promptly, without generator damage by the agent.

Smoke-Detecting System. At Pfizer's request, Walter Kidde & Co Inc tackled the assignment. Assuming that where there's smoke there's fire, they equipped each generator with a modern smoke detector hooked into the air-cooling system.

Samples are drawn continuously from the exhaust air just before it enters the coolers. No external blowers are used. Air travels through ¾-in. pipe, enters the smoke detector, and passes by photoelectric cells. If a sample contains smoke, it increases intensity of reflected light on the cells, causes alarm bells to sound and warning lights to flash on the control panel. After being analyzed, the air sample returns to the generator.

The smoke-detecting system is self-monitoring. If there is trouble in the system—for example, if a photoelectric cell burns out—trouble indicators light up on the control board and buzzers sound.

Fire-Extinguishing System. A carbon-dioxide built-in fire-extinguishing system complements the smoke-detecting system. When the automatic smoke warning sounds, supervisory personnel simply throw one of three switches at control panel, depending on which generator is in trouble.

This electrically actuates five 75-lb cylinders of carbon dioxide. The liquid, under its own pressure, floods through piping and discharges as an inert gas. Nozzles direct it into the air-cooling system of the generator involved.

Two cylinders dump their contents immediately through the initial supply line and nozzle. Gas from the other three cylinders is introduced slowly through the delayed supply pipe.

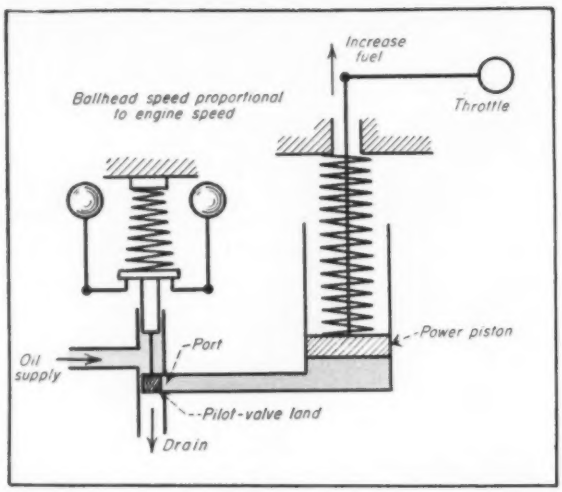
The carbon dioxide, circulating in the cooling system, reaches every part of the generator. It smothers fire by lowering oxygen content of the air to a point that will not support combustion.

A green light to the left of each actuator switch on control panel is normally on, indicating that the system's electrical power is available. Should the source fail, light goes out, and system must be operated manually at the cylinders. When the system is operating, a red light to right of switch flashes on, and an audible alarm sounds.

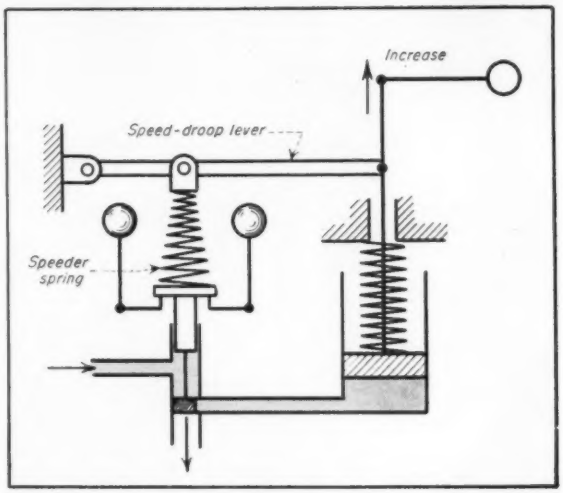
There is enough carbon dioxide to fill the enclosed air-cooling system for more than 30 minutes in effective volume. This is long enough for operator to secure the generator and take appropriate action.

Initial Test. When the detection-extinguishing systems were first installed, tests were run on the two 2500-kw units. Generator No. 1 showed a precooler pressure of .5 in. of water, and an end-bell vacuum of .2 in. No. 2 showed a precooler pressure of .7 in., and an end-bell vacuum of .1 in. Both have 615 cu ft static volume.

An alarm sounded only 20 seconds after artificial smoke was injected into the bell area of generator No. 1. There was no evidence of smoke anywhere outside the generator housing. Powerhouse personnel would have been unaware of trouble until considerably later.



1 Simple combination of a ball head and a direct-connected pilot valve has but one equilibrium position, is unstable



2 Speed-droop lever is used to introduce permanent speed droop to stabilize the action of a hydraulic governor

DIESEL GOVERNORS—III

How Hydraulic Governors Give Better

Using pressurized oil on a power piston increases power available to actuate engine's fuel valve, gives closer control of speed, permits adjustment of unit's speed droop. Here are your basic facts on this type of governor

By **EDGAR J KATES**, *Consulting Engineer, New York, N. Y.*

► LAST MONTH we saw that mechanical governors have certain disadvantages that may preclude their use for some services. Poor sensitivity, small power output unless governor is excessively large, and unavoidable speed droop are included in these disadvantages. Of course they are unimportant in some applications. But for engines needing more sensitive control, greater power for movement of fuel-control mechanism, or identical speed for all loads, hydraulic governors often prove better. Let's see why this is so.

Hydraulic governors have more parts and are more expensive than mechanical types but they have these advantages: They (1) are more sensitive (2) have greater power to move engine's fuel-control mechanism (3) can be made isochronous (identical speed for all loads).

In these governors the power that moves engine throttle *does not* come from the speed-measuring device. Instead, it comes from a hydraulic power piston, or servomotor. This is a piston acted on by a fluid under pressure, generally oil pressurized by a pump. By using an appropriate piston size and oil pressure the power output at the governor's output shaft (work capacity) can be made sufficient to operate promptly the fuel-changing mechanism of the largest engines.

Speed-measuring device, through its speeder rod, is attached to a small cylindrical valve, called the pilot valve. This valve slides up and down in a bushing containing ports, which control oil flow to and from the servomotor. Force needed to slide the pilot valve is extremely small and a small ball head is able to control a large amount of power at the servomotor.

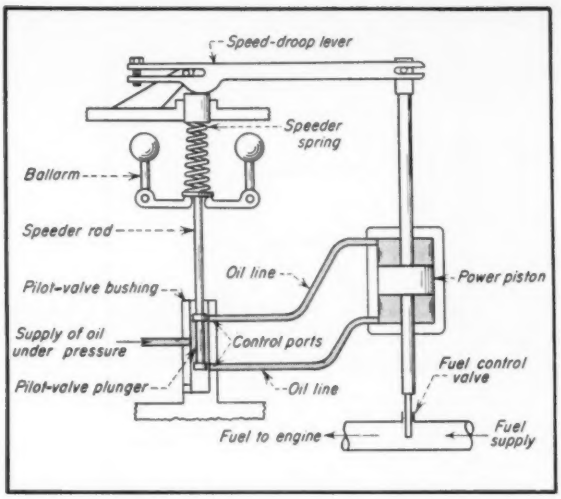
Elementary hydraulic governor, Fig. 1, has the land (raised portion) of the pilot valve equal in width to the port. When governor operates at control speed the land closes port, shutting off oil flow.

If governor speed falls, because of increase of engine load, the flyweights move in and the pilot valve moves down. This opens the port to the power piston and connects it to a supply of oil under pressure. The oil acts on the power piston, forcing it up to increase the fuel flow.

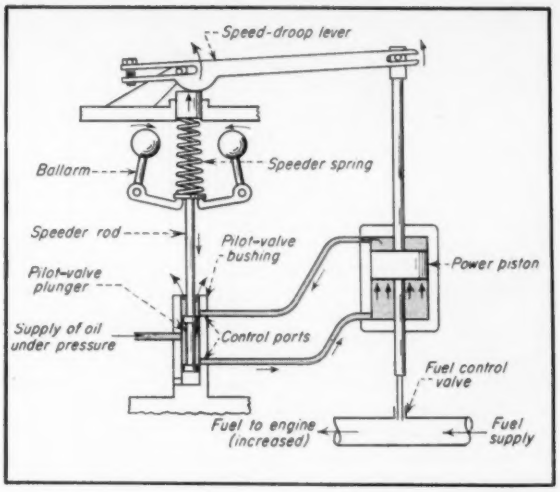
If governor speed rises, because of decrease of engine load, the flyweights move out and pilot valve moves up. This opens port from power piston to a drain leading to the sump. Spring above power piston forces piston down to decrease fuel supply to engine.

Note that port stays closed only at one certain speed, and that throttle can be in any position from full load to no-load at this speed. Ideally, therefore, the engine should run at exactly the same speed at any load and the governor would be called isochronous.

Unfortunately, a simple hydraulic



3 Elements of a simple hydraulic governor that is fitted with speed-droop lever to provide permanent speed droop



4 Action in a simple hydraulic speed-droop governor during load increase. Pilot valve moves down, increases fuel flow

Control for Modern Diesel Engines

governor like this has a serious defect, preventing its practical use. It is inherently unstable. That is, it moves continually, making unnecessary corrective actions. In other words, it hunts. Let's see what causes this.

Hunting is caused by the unavoidable time lag between the moment the governor acts and the moment the engine responds. Engine cannot *instantly* come back to the speed called for by the governor.

If engine speed is below governor control speed, pilot valve is moving power piston to increase fuel supply. By the time engine speed rises to control setting with pilot valve centered and motion of power piston stopped, fuel supply has already been increased too much. Engine speed, therefore, continues to rise. This overspeeding opens the pilot valve the other way to decrease fuel supply. But by the time engine speed falls to the right value, the fuel control has again traveled too far. Engine then underspeeds and the whole cycle repeats indefinitely. Some means of stabilizing governor must be added to provide satisfactory operation.

Speed Droop. To obtain stability, most hydraulic governors employ the principle of speed droop. It gives stability because engine throttle can take only one position for any one speed. When a load change causes a speed change, resulting governor action ceases at the point that gives the amount of fuel needed for the new load. In this way, speed droop prevents unnecessary governor movement and over-correction of fuel supply (hunting).

Note, however, that to prevent hunting the speed droop must be enough to take care of the unavoidable delay while the engine is responding to governor action. If droop is insufficient, some hunting still occurs while engine is returning to its steady speed after the first momentary speed change.

Hydraulic governors may be built with either permanent or temporary speed droop, depending on their application. Governors with permanent speed droop are not isochronous.

Permanent speed droop can be obtained in several ways. One of these, Fig. 2, is to connect a lever between the power piston and speeder spring so speed setting is decreased as fuel supply is increased. Reducing speeder-spring force lowers engine speed; increasing spring force raises engine speed, POWER, Mar, p 73. Speed-droop lever, Fig. 2, performs this function in this governor.

Let's trace action of a hydraulic governor with permanent speed droop, Fig. 3. In it a simple pilot-valve plunger, attached to the end of the speeder rod, slides in a bushing having drilled control ports. Oil lines from these ports connect to both sides of a power piston on the fuel-control rod. Valve ports are just closed when the ball arms are in a vertical position with engine running at desired speed and load.

Load Increase. When load is applied to engine its speed decreases. As speed falls, ball arms move in, Fig. 4, lowering pilot-valve plunger. This opens the ports, allowing oil under pressure to flow through the lower port to underside of power piston to force it up and increase fuel supply. Oil on top of piston flows out of upper port and escapes from top of bushing to a sump.

As power piston moves up, it pushes speed-droop lever up, reducing speeder-spring force. Reduced force allows ball arms to move out, raising the pilot-valve plunger and slowing the further upward movement of power piston. When ball arms reach the vertical position, control ports are closed and power piston stops moving upward.

Since speeder-spring force is reduced as fuel or load increases, a balance is reached with less flyweight force, that is, with lower engine speed. Reduction of engine steady speed caused by load increase is the speed droop. Note that speed-droop lever prevents over-correction of fuel (hunting) by stopping power-piston corrective movement *before* the engine returns to its previous running speed.

Load Decrease. As load drops, engine speed rises. Governor ball arms move

out, raising pilot-valve plunger, Fig. 5. Raising the plunger opens control ports so oil under pressure can flow through port to upper side of power piston. Oil pressure forces piston down to reduce fuel supply. Oil under piston escapes through the lower port to the sump.

As power piston moves down it pulls the speed-droop lever down, increasing the speeder-spring force. Larger force pushes the ball arms in, lowering the pilot-valve plunger and slowing the further downward motion of power piston. When ball arms reach the vertical position, control ports are closed and power piston has stopped moving.

Since speeder-spring force is increased as load is reduced, it requires more weight force—that is, a higher engine speed—to balance the spring force. Increase of engine steady speed caused by load decrease is the speed droop. It prevents hunting by stopping the corrective movement of the power piston *before* the engine returns to its previous speed.

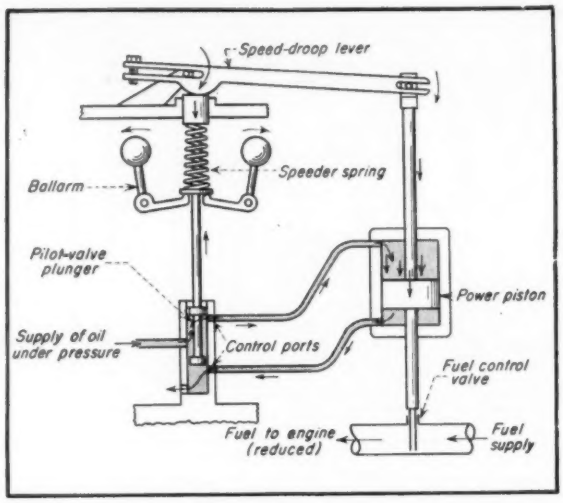
Advantages of this type hydraulic governor include: (1) relatively inexpensive (2) accurate and sensitive, giving good speed control (3) simple for a hydraulic governor, has few parts (4) more powerful than a mechanical governor of similar dimensions.

Disadvantages include: (1) not isochronous (2) speed-droop adjustment is inconvenient because it is made inside the governor.

Fig. 6 shows the internal construction of a commercial hydraulic governor employing permanent speed droop to obtain stability. Its parts are labeled to correspond with those in Fig. 3, 4 and 5. In addition, Fig. 6 shows the pump that supplies oil at 120 psi and the accumulator or reservoir that keeps the oil at constant pressure.

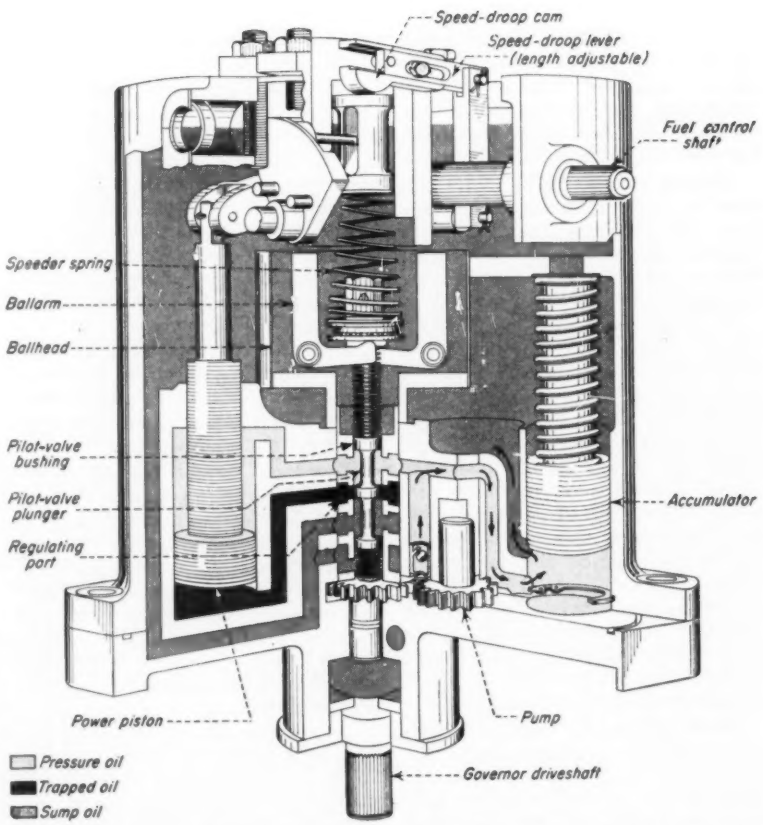
Ball head is rotated by the governor drive shaft through the pilot-valve bushing. Amount of speed droop may be changed by adjusting the length of the 2-part speed-droop lever. Speed adjustment is provided by a knob (not shown), which raises or lowers the upper seat of the speeder spring.

Our next article will discuss isochronous hydraulic governors and how they work in modern diesel engines.



5 Load decrease causes flyweights to move out and raise the pilot valve to push the power piston down and reduce fuel

Governor, Below, Has Adjustable-Speed Droop



6 Cross section through a hydraulic governor having permanent speed droop. The oil pump maintains a pressure of 120 psi for the operation of the servomotor

World's largest pumped-storage hydro project in Austria uses over 4100-ft head from reservoirs 6700 ft above sea level. It will have two of the most powerful pelton turbines and highest-powered pumps

By **BARBARA JEAN TUFTY**
Paris Correspondent

1 Mountainous terrain where there are no roads required use of six cableways to handle men and materials. Limberg Dam can be seen across valley in background

Little Rivers Plus Pumped Storage and High Head Make Big Peak-Load Power

► On the Kaprun River in Austria, the world's largest and most outstanding pumped-storage hydroelectric power project—450,000 hp—is under construction. Most of the flow in Austria's rivers comes from high mountains where temperatures drop to 50 F below zero, and snow and ice pile up 30 to 40 ft deep. As a result, runoff in winter is only about 12% of the summer flow. But, in the fall and winter months the base and peak loads are highest, when runoff to rivers is the lowest.

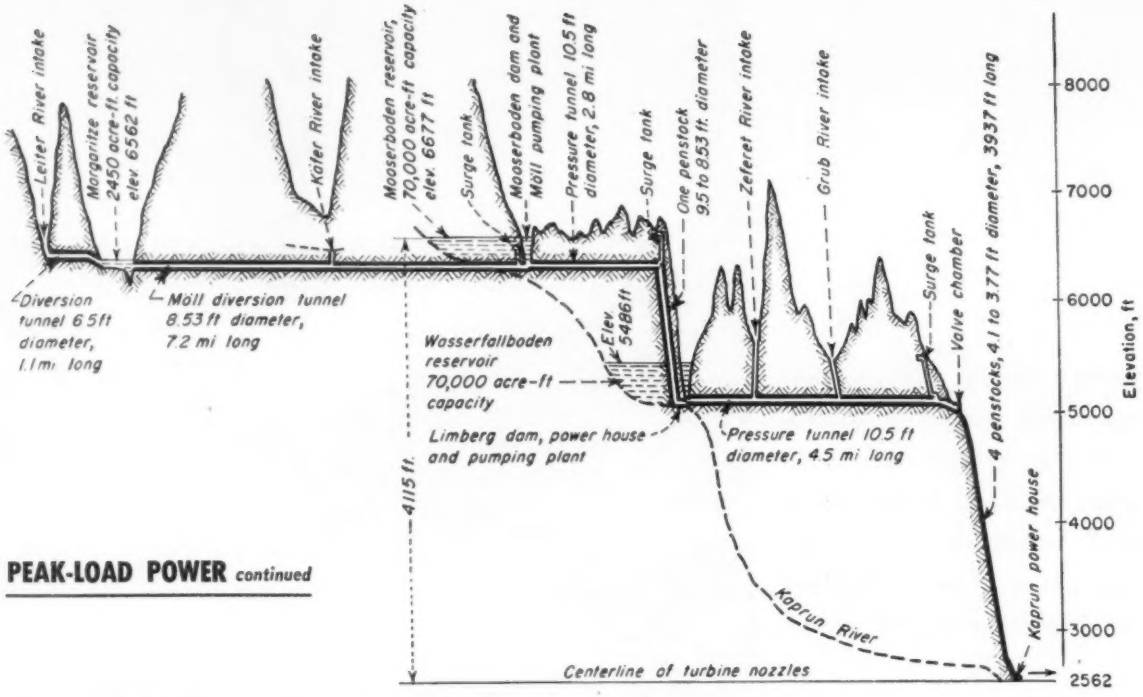
Glockner-Kaprun Project. Hydroelectric plants on the power system require large storage capacity for the high summer flow from melting mountain snow and ice so water will be available for the heavy winter load when runoff is low. If this is not done, the power deficiency from hydro plants must be supplemented by burning expensive fuel in steam or diesel plants.

It is to compensate for the lack of water for winter power generation that the Glockner-Kaprun development is being made. Melting snow from the Grossglockner Mountains, two miles above sea level, will be stored in a series of reservoirs and used to generate power for all Austria.

When this project is completed and pumping plants are operating in 1955, it will supply more than 800 million kwhr per year, over 10% of Austria's total power use. Of this, 75% (600 million kwhr) will be available in winter, 25% (200 million kwhr) in summer. The latter is power generated from water for which reservoir capacity is not available. With Marshall Plan economic aid the largest part of the main power project has been completed.

Project Outline. The project includes 15.6 miles of tunnels, three storage reservoirs with 142,000 acre-ft storage capacity, two power-generating stations and two pumping plants. By pumped storage a maximum static head of over 4100 ft is made available in the two power plants. Even if the water quantities are comparatively small and collected from several small drainage areas, they are valuable for power production because of the high head. Further, about 75% of the total power will be generated in the six winter months to supply high-cost peak loads, when water flow to other plants is low.

Fig. 2 shows a profile of the project;



PEAK-LOAD POWER *continued*

2 Profile of the Glockner-Kaprun pumped-storage hydroelectric development. It includes 15.6 miles of tunnels, three storage reservoirs, a pumping plant and two power stations (one pumped storage) to use a total static head of over 4100 feet

it starts with a 1.1-mile tunnel, 6.5 ft in diameter, that drains Leiter River into Margaritze Reservoir on the Moll River. Formed by two concrete-arch dams, this reservoir with water surface at maximum elevation, 6562 ft, stores 106,000,000 cu ft (2450 acre-ft) of water, but can be drawn down 68 ft to elevation 6494 ft. A total area of 25 sq mi including the Moll River drains into this reservoir.

Moll Pumping Plant. Moll diversion tunnel, 7.2 miles long and 8.5 ft in diameter, connects Margaritze Reservoir with an underground pumping plant and surge tank at Mooserboden Reservoir on the head waters of the Kaprun River. This reservoir is formed by two arch dams, 328 and 312 ft high, that contain a total of 1,300,000 cu yd of concrete. About halfway along the tunnel, Kafer River is diverted into it to recover the drainage from a 4-sq-mile area. Mooserboden Reservoir also receives the water from about 9-sq-mile drainage around it.

The pumping plant has two single-stage pumps, each rated 150,000 gpm under 200-ft head and driven by an 8000-hp motor. These pumps take water directly from the Moll diversion tunnel and discharge into the Mooserboden Reservoir, which, when filled to maximum elevation 6677 ft, has a capacity of 3,000,000,000 cu ft (70,000 acre-ft). It can be drawn down 249 ft to elevation 6430. Because of the wide range of water levels in the Margaritze and Mooserboden Reservoirs and the friction head losses in the tunnel and connections to the pumps, head on them can vary from 66 to 297 ft.

This pumping plant (1) stores water that might otherwise run to waste (2) increases the system's water-storage capacity (3) increases the head over 100 ft on the plants farther down the river. As a result the power used in pumping is made available and multiplied several times under a high head to supply winter peak loads.

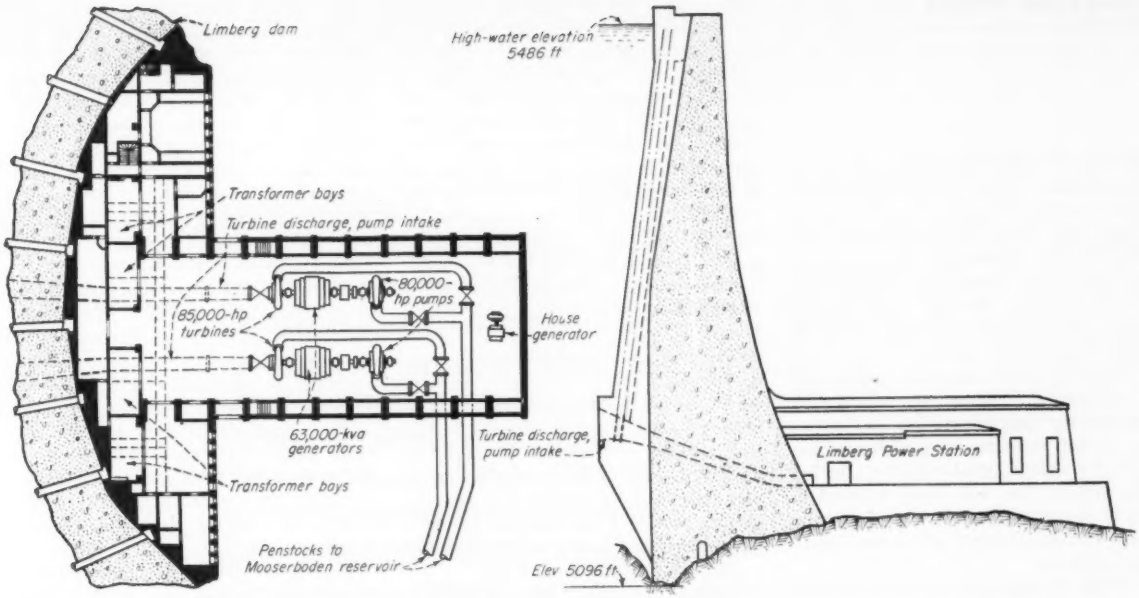
Limberg Power Plant. From Mooserboden Reservoir a pressure tunnel, 10.5 ft in diameter and 2.8 miles long, runs to a surge tank above the Limberg power-generating and pumping plant, Fig. 3 and 4. One steel penstock, 9.5 to 8.53 ft in diameter and 1650 ft long, in an inclined tunnel, leads from a butterfly valve down inside the face of the cliff to two units in a plant built into the toe of Limberg Dam. This dam, on the Kaprun River, is a concrete arch 390 ft high from the lowest point in its foundation. When filled to its maximum water level, elevation 5486 ft, the reservoir formed by this dam has 70,000 acre-ft capacity, the same as Mooserboden. It can be drawn down 260 ft to elevation 5226 ft.

Each of the two units in the plant consists of a horizontal-shaft 85,000-hp 500-rpm francis turbine coupled to a 63,000-kva 3-phase generator, which, in turn, connects through a coupling to a large 2-stage centrifugal pump, Fig. 3. Each turbine discharges through the Limberg Dam into Wasserfallboden Reservoir against a head from 50 to 320 ft.

Because of water-level variations in Mooserboden and Wasserfallboden Reservoirs, head on the Limberg turbines varies from 977 to 1435 ft. When operating at their higher heads, they are among the highest-head francis turbines in the world and also the largest units for these heads.

For heads above 1200 ft, pelton wheels would normally be installed. They could not be used at Limberg because pelton turbines must at all times operate above tailwater level, and cannot have their discharge flooded. Limberg turbines, instead of discharging into a draft tube under a vacuum as francis turbines normally do, will have their discharge flooded at all times under a head from 50 to 320 ft—an impossible condition for a pelton wheel. This is the only installation in the world where francis turbines operate continuously with such a high positive pressure on their discharge.

Even if high discharge head had not made francis turbines a necessary selection, other advantages would have favored their choice. Their speed, higher than that of Pelton wheels, reduced the size and cost of generators and pumps. At 500 rpm it was possible to use



3 Each of the two Limberg units consists of an 85,000-hp francis turbine, 63,000-kva generator, and 80,000-hp pump

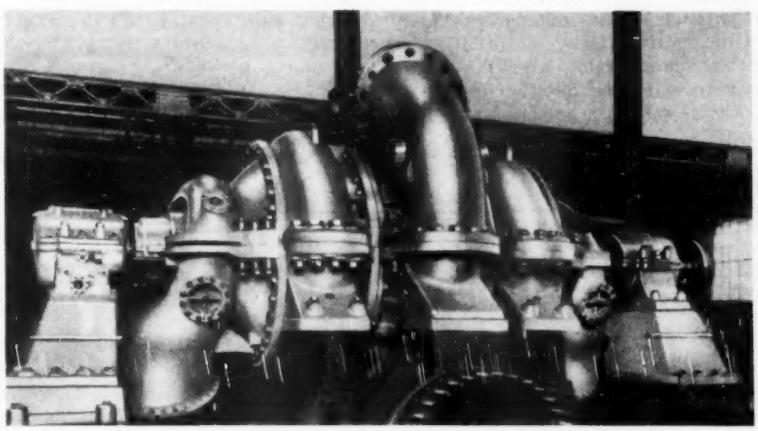
4 Limberg powerhouse is built in the toe of the dam that forms the reservoir into which the two turbines discharge

comparatively simple 2-stage pumps, whereas at a lower speed a more complicated design with more stages would have to be used. The high flywheel effect that could be built into the rotating elements of the machines simplified the problem of controlling the pumps if power to them failed, as shown later.

Limberg Pumps. During operations the generators will operate as synchronous motors to drive the pumps, using off-peak and surplus power from the system. These pumps, using the turbine discharge conduits through the dam as intakes, take water from the Wasserfallboden Reservoir and store it in Mooserboden against a maximum total head of nearly 1500 ft. Each double-suction 2-stage pump is rated 200,000 gpm against a 1350-ft head, and will require 80,000 hp to drive it. This makes them the next highest-powered pumps in the world, and, for their capacity, the highest-head units.

Each pump has two single-suction runners in the first stage that discharge into a double-suction second-stage runner. Fig. 5 is a shop photo of a 62,000-hp pump built for the Provvidenza pumped-storage hydroelectric plant in Italy. This pump is practically the same as those being built for Limberg except in power input.

When generating power, the pump discharge valve is closed, while the turbine's discharge and penstock valves are open. The pump is disconnected from the generator by opening a coupling, so the power unit operates free of the pump. This coupling is opened and closed by an oil servomotor.



5 This 62,000-hp pump in Provvidenza pumped-storage hydroelectric plant in Italy is similar to the two 80,000-hp pumps being built for the Limberg plant, Austria

How Pump Is Started. To start the pump the coupling between it and the generator is closed. Then the whole unit is brought to speed with the pump full of water and its discharge valve closed. Under this condition the pump takes about 33% of its normal power. At a speed of 500 rpm the generator is synchronized and connected to the power system.

As the penstock and discharge valves are closed on the turbine, the generator as a synchronous motor picks up the load of driving the pump. When the valves are closed on the turbine, its casing drained and the discharge valve opened on the pump, the latter then transfers water from Wasserfallboden to Mooserboden Reservoir. During pumping operation the turbine runner revolves in air, being driven with the pump by the generator operating as a synchronous motor.

These pumps will make it possible to

operate this plant on peak-load service through the year. Using low-cost off-peak power, water is pumped between peak loads from Wasserfallboden into Mooserboden Reservoir. During peak periods, water flows back through one of the Limberg turbines into Wasserfallboden Reservoir to supply the peak load on the power system.

In addition, the pumping plants will permit filling all three reservoirs during summer for winter operation, when there is a lack of water to operate other plants on the system at rated capacity. During the summer, the only water allowed to go to Kaprun plant farther down the river is that in excess of reservoir storage capacity.

Pump Control. The Limberg pumps, like others operating under similar conditions, must be protected against reverse rotation if power to them fails. Control of the discharge valve on each pump is so arranged that the valve starts to close as soon as power to its motor fails. In these units energy stored in the rotating mass, particularly in that of the generator, keeps the pump rotating in normal direction until the discharge valve can be closed. Closing time of the valve is long enough so excessive pressure surges are not caused in the penstock.

Each pump requires a large block of power to operate it, all of which may not be available as surplus from the system when a pump should operate. When this condition exists it is planned to use the turbine to supply the deficiency. For example, assume the pump requires 80,000 hp and only 50,000-hp surplus power is available from the system for the pump motor. To supply the other 30,000 hp the turbine gates will be partly opened.

The pump now operates at full capacity but only part of its discharge goes to the Mooserboden Reservoir, the remainder returns to the turbine. In this way a pump can operate at any time during off-peak periods and the electric pumping load be adjusted to use the surplus power of the system. It is also planned to use this method of operation to help hold system frequency.

Kaprun Plant. From the Wasserfallboden Reservoir a pressure tunnel, 10.5 ft in diameter and 4.5 miles long, leads to a surge tank and valve chamber above the Kaprun plant. At two points along the tunnel the Zeferet and Grub Rivers flow into it from a drainage area of 3.5 sq miles. Four penstocks, 4.1 to 3.77 ft in diameter, run 3937 ft down to four horizontal-shaft pelton turbines now in operation in the plant.

Two of these units are a double-overhung design, each wheel having two nozzles. Each unit is rated 83,000 hp, 500 rpm, which puts them among the highest powered of their type in operation in the world. A 3-phase 70,000-kva 0.80-pf 10-kv generator is on the shaft between each pair of turbine wheels. The other two units have double overhung wheels, each with a single nozzle. These units are rated 64,000 hp, connect to 50,000-kva 0.90-pf 3-phase 10-kv generators, and operate at 500 rpm.

Center line of the turbine nozzles is at elevation 2562 ft. With Wasserfallboden Reservoir filled to elevation 5486 ft, static head is 2924 ft. Effective head on the plant varies with water elevation in Wasserfallboden Reservoir, but generally ranges from 2700 to 2900 ft. Static head on the system with Mooserboden Reservoir filled is 4115 ft. Under maximum head conditions 1191 ft of this is used in Limberg plant and 2924 in Kaprun.

Electric Equipment. At Limberg plant (now under construction) in an indoor transformer and switching station, power-system voltage will be stepped down from 110 to 10 kv to supply the Moll pumping plant. Two 62,000-kva transformers step up generator voltage to 110 kv, and connect by a double line to the 110-kv double bus in the outdoor switchyard at Kaprun power station. At this station the two 50,000-kva generators connect to two 50,000-kva, 10- to

(*Continued on page* 202)

Other Large Hydroelectric Projects

► LARGE SIZE of the Glockner-Kaprun project, the high ratings of its equipment, and the high heads lead the editor to draw comparisons with other great hydro developments in the world.

High-Head Francis Turbines. It is interesting to compare the Limberg francis turbines with other high-head units of the same type. The highest-head francis turbines in the world are the two vertical-shaft 63,200-hp 750-rpm units installed in the Fionnay plant in Switzerland that operate under a static head of 1007 to 1550 ft, 932 to 1525 ft effective. A close second to these units is the 69,000-hp 500-rpm unit that operates under 1360-ft head in the Vinstra plant in Norway.

Coming to the U.S., the Flatiron plant of the U.S. Bureau of Reclamation on the Colorado-Big-Thompson development, now under construction, will have two 48,000-hp 514-rpm francis units. These are designed for a static head of 1130 to 1000 ft, and an effective head of 1045 ft.

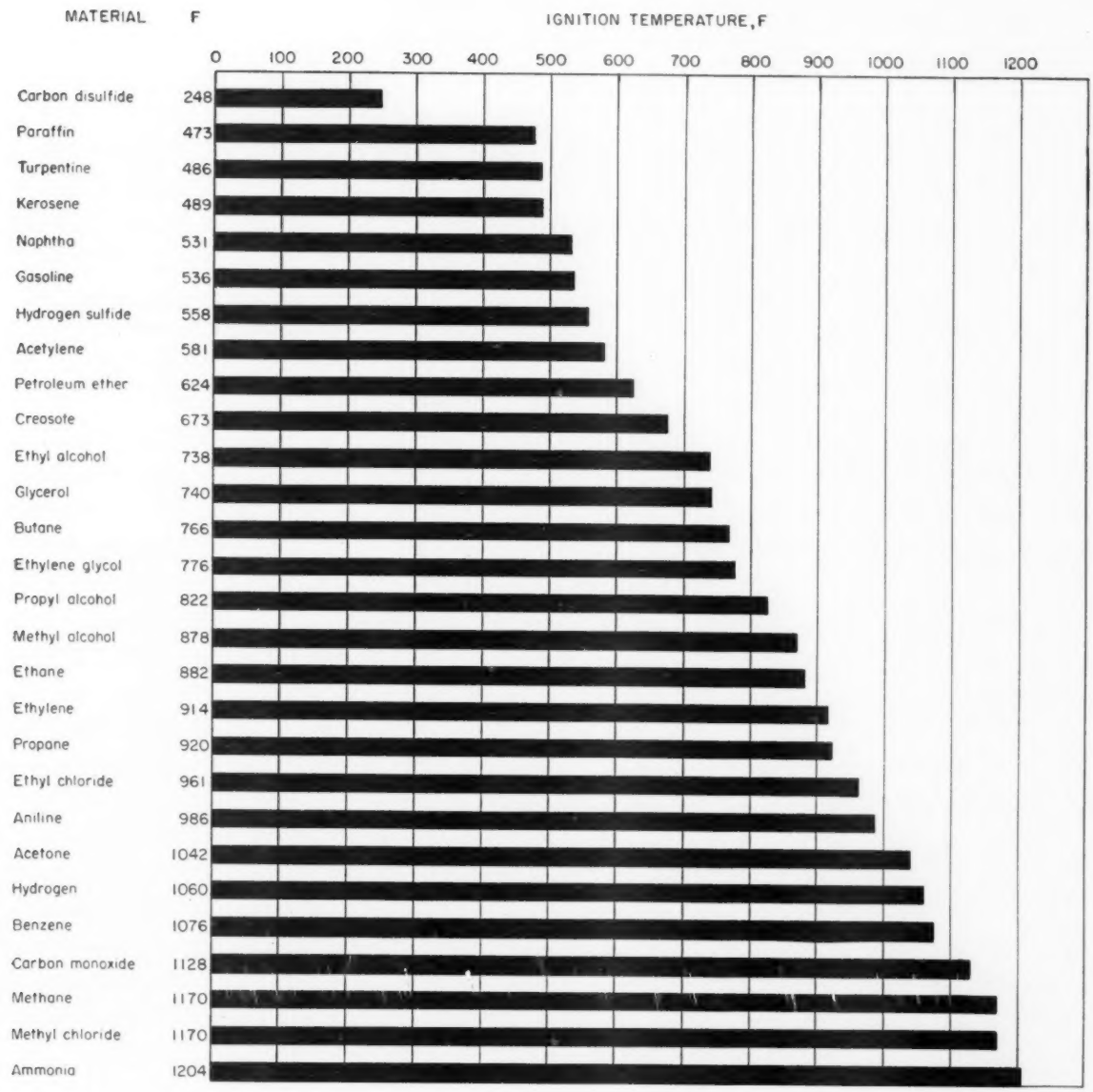
Pelton Turbines. Even though the Kaprun turbines are among the largest in the world, they do not operate under the highest head. The Dixence plant in Switzerland has five 50,000-hp units that operate under a maximum head of 5740 ft. In France, the Pragnieres plant has a 100,000-hp unit for a 3920-ft head. For power rating, the 16 units to be installed by the Aluminum Co of Canada in its Nichako-Kemano plant in Northwest British Columbia will have the largest. These are a 4-nozzle vertical-shaft single-runner design, rated 140,000 to 150,000 hp at 327 rpm under 2585 gross head. Three of these units now being built are scheduled for 1954 operation. The machines are exceeded in capacity only by the eighteen 170,000-hp francis turbines in the Grand Coulee plant on the Columbia River in the U.S.

Large Pumps. Pumps may be compared on a power, discharge or head basis. Closest to the Limberg units on a power basis are the single-stage pumps installed at Grand Coulee Dam. There will be 12 of these, each driven by a 65,000-hp motor, six of which are now being installed. What will be the largest turbine-pump in the world is being built for the Hiwassee plant of the Tennessee Valley Authority. As a turbine this unit will develop 80,000 hp at 105.9 rpm and will discharge 3900 cfs (2,500,000,000 gpd) against a head of 205 ft, and require 102,000 hp for driving.

These units do not by any means include all the outstanding ones, but they do give an idea of some of the highest-powered and highest-head machines.

Power's DATA SHEET

No. 251



Ignition Temperatures for Vapors and Gases

► IGNITION TEMPERATURES for the same gas or vapor vary with test method, the size, shape and material of the testing container and other factors. Within a given homologous series of hydrocarbons, ignition temperatures decrease with an increase in molecular weight. For instance, methane has a higher ignition temperature than propane.

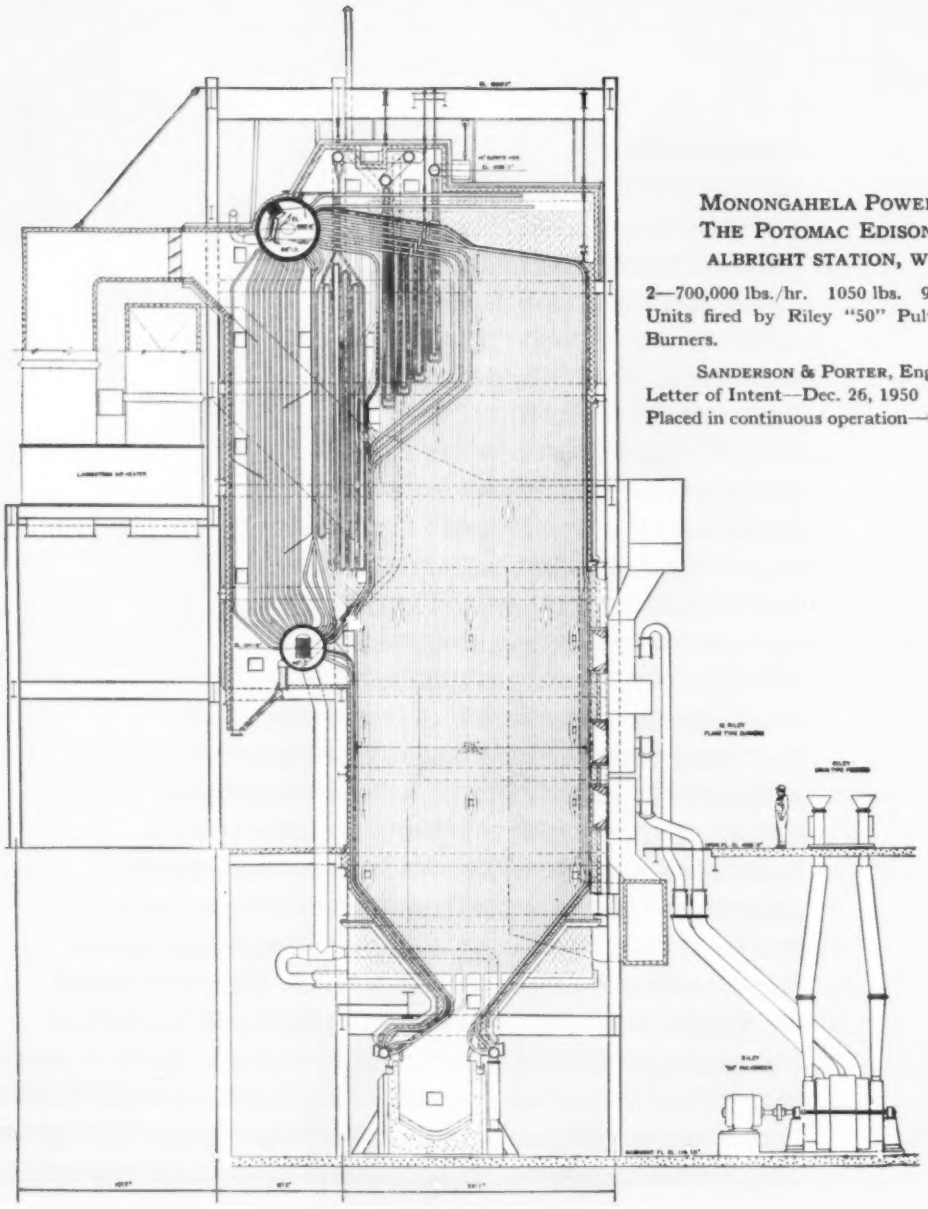
Ignition temperature is the minimum temperature to which a combustible vapor-air mixture must be raised to start combustion. An adequate supply of oxygen must be mixed with the gas or vapor to support continuous burning.

The data above will help in selecting proper storage methods and areas for liquids and gases of a highly combustible nature used in industry.

JOHN D CONSTANCE

Cliffside Park, N. J.

700,000 lbs./hr. Riley Units at



MONONGAHELA POWER CO.
THE POTOMAC EDISON CO.
ALBRIGHT STATION, W. VA.

2—700,000 lbs./hr. 1050 lbs. 905°F. Riley Units fired by Riley "50" Pulverizers and Burners.

SANDERSON & PORTER, Engineers
Letter of Intent—Dec. 26, 1950
Placed in continuous operation—Oct. 1, 1952.

RILEY

STOKER CORPORATION, WORCESTER, MASS.

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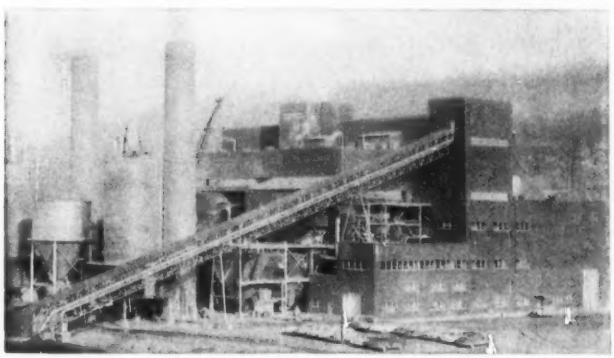
BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • ECONOMIZERS

Albright Station go on the line

21 months after letter of intent

A letter of intent dated December 26, 1950 was given Riley Stoker Corporation by Monongahela Power Co. and The Potomac Edison Company covering the first two 700,000 lbs./hr. units for their new Albright Station. In spite of the fact that this was a completely new station and the difficulties in procurement of materials, the first unit was placed in continuous operation October 1, 1952, only 21 months after date of award, performing as guaranteed and predicted, and without the necessity of shutdowns for adjustments or corrective measures.

It is because of performance like this—engineering, fabrication, erection and operation of the equipment—that so many public utilities and industrials have swung to Riley. By investigation and experience one after another has found that you can rely on Riley. Be sure to investigate Riley equipment and request a Riley proposal when considering new steam generating or fuel burning equipment. You will be glad you did so.



A Few Recent Riley Public Utility Units

TEXAS ELECTRIC SERVICE CO.
1,250,000 lbs./hr. 2125 psig, 1005°F. and 1005°F. reheat

DALLAS POWER & LIGHT CO.
1,250,000 lbs./hr. 2125 psig, 1005°F. and 1005°F. reheat

HOUSTON LIGHTING & POWER CO.
1,250,000 lbs./hr. 2125 psig, 1005°F. and 1005°F. reheat

DEPARTMENT OF WATER AND POWER CITY OF LOS ANGELES, CALIFORNIA
1,200,000 lbs./hr. 2075 psig, 1000°F. and 1000°F. reheat.

LOUISIANA POWER & LIGHT CO.
1,000,000 lbs./hr. 1725 psig, 1005°F. and 1005°F. reheat.

SOUTHWESTERN GAS & ELECTRIC CO.
630,000 lbs./hr. 1050 psig, 1005°F.

MONONGAHELA POWER CO.
700,000 lbs./hr. 1050 psig, 905°F.

UTAH POWER & LIGHT CO.
575,000 lbs./hr. 1700 psig, 1000°F. and 1000°F. reheat.

CENTRAL ILLINOIS LIGHT CO.
600,000 lbs./hr. 950 psig, 900°F.

NORTHERN STATES POWER CO.
385,000 lbs./hr. 1500 psig, 950°F.

SOUTH CAROLINA PUBLIC SERVICE AUTHORITY
460,000 lbs./hr. 1025 psig, 900°F.

THE POTOMAC EDISON CO.
700,000 lbs./hr. 1050 psig, 905°F.

IOWA ELECTRIC LIGHT & POWER CO.
300,000 lbs./hr. 975 psig, 910°F.

GULF POWER CO.
325,000 lbs./hr. 1000 psig, 900°F.

SOUTH CAROLINA GAS & ELECTRIC CO.
400,000 lbs./hr. 1475 psig, 955°F.

UTAH POWER & LIGHT CO.
620,000 lbs./hr. 1500 psig, 955°F.

IOWA-ILLINOIS GAS & ELECTRIC CO.
250,000 lbs./hr. 975 psig, 905°F.

PUBLIC SERVICE CO. OF INDIANA
400,000 lbs./hr. 1000 psig, 910°F.

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

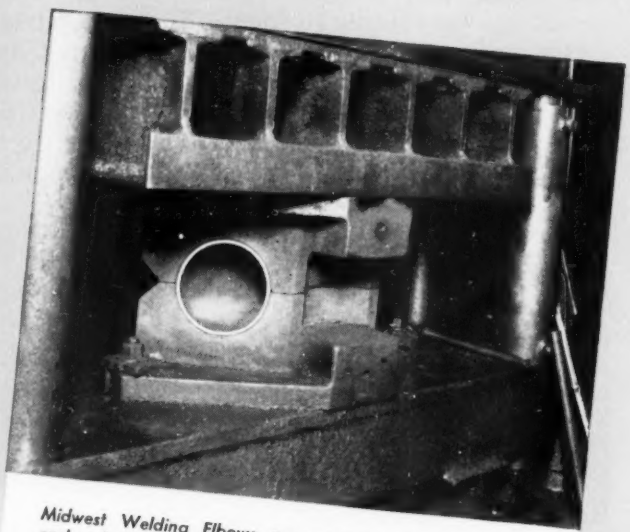
COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

Held to CLOSE LIMITS

The child cooped in his playpen is held to close limits for his own safety and health. Midwest Welding Fittings are held to close limits to save you time and money on your welded piping. Because of their exceptional dimensional accuracy and uniformity (see below), all pipe can be cut in advance according to drawings with assurance of accurate fit. Welders do not have to spend costly time struggling to line up fittings and pipe. Welding proceeds rapidly and economically with no time-wasting compensation for inaccuracies. It will pay you to specify "Midwest" the next time you order welding fittings.



Midwest Welding Elbows are accurately sized in totally enclosed compression dies that exactly control metal distribution throughout fitting. The result is true circular cross section and accurate radius, included arc, and tangents.

MIDWEST PIPING COMPANY, INC.
(Formerly Midwest Piping & Supply Co., Inc.)
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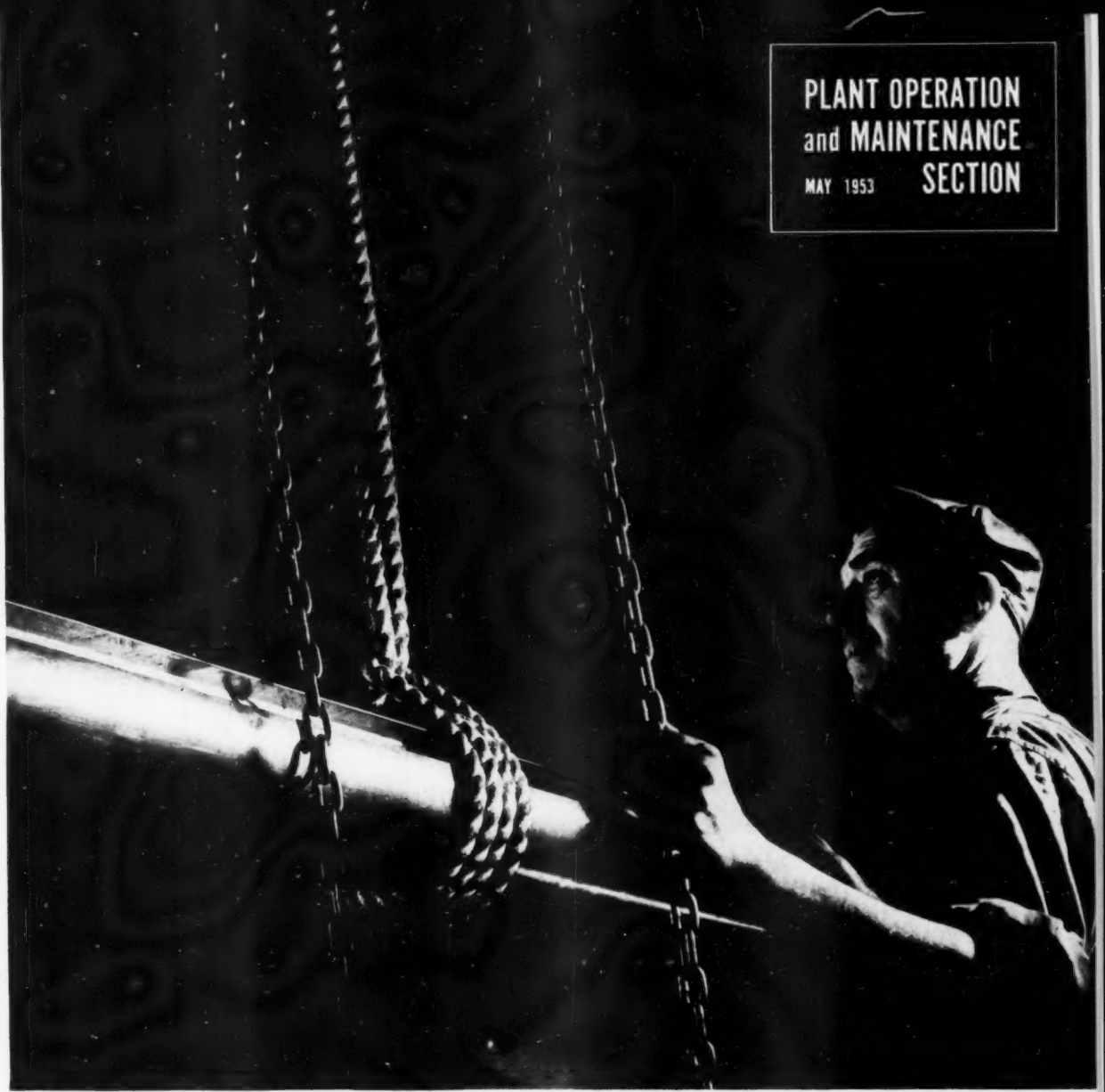
MIDWEST WELDING FITTINGS

6108

MIDWEST WELDING FITTINGS Improve Piping Design and Reduce Costs



ROPE for general industrial use is handy because it's flexible, light. But use a rope wtih safety factor of 5 to 1 for the load

"Pick It Up?"

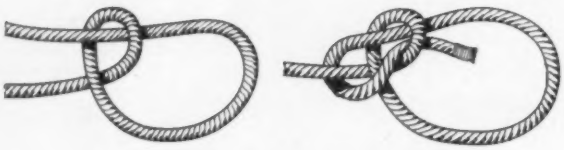
By **JOHN R SEARS**, *Brooklyn Navy Yard*

Rigging jobs come up often around plants, but usually few landlubbers know too much about them unless they have sailed aboard ship. It takes know-how to work safely with manila rope, wire cable, chain hoists, while saving costly manhours

► "PICK IT UP, it ain't spit!" Sounds like something old Marmaduke Surfaceblow might bellow at a well-intentioned but unhurried wiper boy on the SS *Suretosink*. But how many of us with plenty of plant experience know all we should about how to "pick it up"?

Safety committees and insurance companies put up enough posters on safe manual lifting so we ought to know the important things: Bend your knees, keep your back straight, push with your legs instead of lifting with your back—and if it's too heavy for one man, get some help. If it's still too heavy, then you've got to resort to some kind of rigging. *(More on next page)*

Handy Knots, and Things to Know About Rope

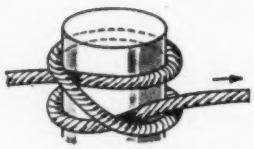


Bowline in Two Steps

Because a bowline won't slip or jam and is easy to untie, it is one knot that every maintenance man should know. Just run bight (end) through loop, then down and through same loop

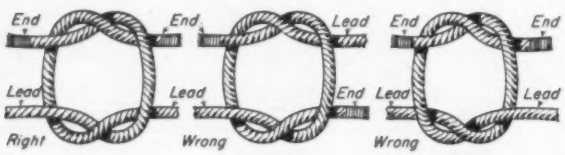
Weaver's Knot

This is form of bowline and is best knot for tying two lines that have unequal diameters



Clove Hitch

Tie onto a pole or pipe with a clove hitch. Knot holds and is easy to untie in a hurry



Square **Thief** **Granny**

These look like square knots but only the first is reliable. Square knot won't slip but it's harder to untie than bowline—harder it's pulled, tighter it grips. Other two slip; are dangerous

Mouse a Hook

Wrap marlin around hook tightly if load might tilt or cant

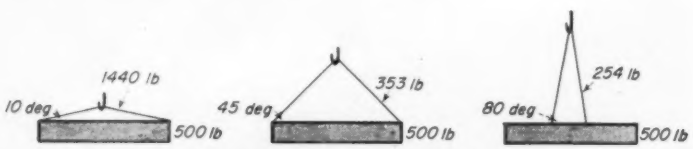
Scaffold Hitch

To keep scaffold from slipping, make a clove hitch *(top, right)* and spread out, then bring the two leads back up

Overhand Knot

Start this barrel hitch as though tying an ordinary overhead knot. Then open it up as shown, and slip the barrel inside. Use the bowline above the barrel

Barrel Hitch



Angle Affects Pull on Rope

Remember that the more acute the angle between the sling legs and the plane of load, the greater the tension in the legs. Sketches show same load, yet strain varies from only 254 pounds to 1440 pounds here

One of the first things every man should master in rigging is a few simple knots. Though you can never know too many knots, it's far better to be perfect in a couple of those that you'll find most use for. That beats being familiar with the whole book and never being quite sure whether a certain knot will hold.

Knots. Principle of any good knot is just this: No two lines that would move in the same direction if the knot slipped, should lie next to and touch each other. A second must of a good knot is that it should be easy to untie. But be sure to remember that no knot is as strong as the rope it's made of.

Bowline, sketch, is very useful. Its strength is about 60%. You can join two lines by looped bowlines or by weaver's knot. The square knot, in the sketch, is about half as strong as its line, but it's simpler to tie than the bowline. Barrel hitch and clove hitch, shown, complete the minimum number of knots you should know for stationary plants.

Safety Factor. Another must when using rope is always to allow enough margin of safety in rope strength to be used for any given load or pull. For general industrial work, and with a first-quality new rope, a safety factor of 5 to 1 is usual.

That means the minimum, tested breaking strength of a rope should be at least five times the amount of strain, in pounds, to be placed on it. Minimum breaking strength for 3/16-in.- to 4-in.-diameter rope is given in the table. With this information, you should be able to size rope for each job. But, remember, this is for new rope, not just any rope you might have around your plant.

Loads. In picking up loads over 500 lb, use only wire-rope sling. Textile rope, such as manila, hemp or sisal, should never be used on loads over that amount. But be careful when using a wire sling singly, especially if hooked by a spliced eye in the wire. With the weight straight on a single wire, the cable may untwist and the splice may open and slip. Kinks in a wire cable should never be pulled through. Take them out as carefully as you'd take out a kink in copper tubing.

Slings. While rigging a sling, as angle between legs becomes larger, stress in the wire increases rapidly. In other words, the longer the sling the better, up to a certain point. You've got to judge between stability of the load and stress on the wire.

Eyebolts. Load direction through an eyebolt should be as close to the axis of bolt as possible. That's because stress in the bolt also increases as the angle between load direction and bolt axis increases. For instance, a one-inch forged eyebolt will take a safe load of about 2½ tons in a straight pull, but only 1/10 of a ton at 90 degrees. You figure it out. That's a 25 to one ratio as you go from a direct pull to a right-angle load.

Handy Table of Rope Sizes and Strengths

3-strand rope, standard lay; use at least 5 to 1 safety factor

Nominal Size: Threads	Nominal Size: Circumference In.	Nominal Size: Diameter In.	Net wgt of 100 feet Lb	Minimum length in one lb (net wgt) Ft	Approximate gross wgt full coils Lb	Minimum breaking strength of good rope: Manila Lb	Minimum breaking strength of good rope: Sisal Lb
6-Fine	9/16	3/16	1.47	67.9	50	450	360
6	3/4	1/4	1.96	51.0	50	600	480
9	1	5/16	2.84	35.2	50	1,000	800
12	1 1/8	3/8	4.02	24.9	50	1,350	1,080
15	1 1/4	7/16	5.15	19.4	63	1,750	1,400
18	1 3/8	15/32	6.13	16.3	75	2,250	1,800
21	1 1/2	1/2	7.35	13.6	90	2,650	2,120
	1 3/4	9/16	10.2	9.80	125	3,450	2,760
	2	5/8	13.1	7.65	160	4,400	3,520
	2 1/4	3/4	16.3	6.12	200	5,400	4,320
	2 1/2	13/16	19.1	5.23	234	6,500	5,200
	2 3/4	7/8	22.0	4.54	270	7,700	6,160
	3	1	26.5	3.78	324	9,000	7,200
	3 1/4	1 1/16	30.7	3.26	375	10,500	8,400
	3 1/2	1 1/8	35.2	2.84	432	12,000	9,600
	3 3/4	1 1/4	40.8	2.45	502	13,500	10,800
	4	1 5/16	46.9	2.13	576	15,000	12,000
	4 1/2	1 1/2	58.8	1.70	720	18,500	14,800
	5	1 5/8	73.0	1.37	893	22,500	18,000
	5 1/2	1 3/4	87.7	1.14	1,073	26,500	21,200
	6	2	105.0	0.949	1,290	31,000	24,800
	6 1/2	2 1/8	123.0	0.816	1,503	36,000	28,800
	7	2 1/4	143.0	0.699	1,752	41,000	32,800
	7 1/2	2 1/2	163.0	0.612	2,004	46,500	37,200
	8	2 5/8	187.0	0.534	2,290	52,000	41,600
	8 1/2	2 7/8	211.0	0.474	2,580	58,000	46,400
	9	3	237.0	0.422	2,900	64,000	51,200
	9 1/2	3 1/8	264.0	0.379	3,225	71,000	56,800
	10	3 1/4	292.0	0.342	3,590	77,000	61,600
	11	3 1/2	360.0	0.278	4,400	91,000	72,800
	12	4	426.0	0.235	5,225	105,000	84,000

Power editors wish to thank Plymouth Cordage Co. for permission to use this table and the "How to" figures in the column at the right.

How to Take Care of Your Rope

Uncoil Rope Properly

Unwind right-laid rope counter-clockwise. Lay coil flat — pull end up through the center of coil

Dry Rope If It Gets Wet

Don't ever store wet rope. First dry thoroughly to avoid short life, loss of strength and even mildew

Overloading Is Risky

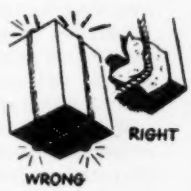
Safety factor is ratio of minimum breaking strength to load. Make 5 to 1 on new rope

Slack Off The Guys

Guy lines and other supports exposed to the weather tighten up from wetting; keep them slack

Sharp Bends Are Very Bad

Extra strain on outer fibers from sharp bends reduce rope's tensile strength. Pad corners as shown



Reverse Rope End-for-End

Localized wear in short section is bad. Reversing rope ends helps all sections get needed equal wear

Keep Rope Kink-Free

Twisting and kinks harm rope structure. Avoid these if you want most service from your good rope

Wire Cable. How can you check a wire cable? You *don't* do it by running your hand over the wire—that's one of the easiest ways to pick up some nasty metal slivers. You *do* look the wire over completely. If more than 10% of the wires in one running foot are broken, the cable is unsafe.

Chain Hoist. A weak chain is not easily detected. It may look just a little old and rusty, yet may have reached its fatigue limit and be full of invisible cracks. Then it will suddenly break without warning. So, chain hoists and chains used for lifting should be inspected and tested for 150% capacity. Inspect them at least every 12 months. If you notice a kink in a chain when making a lift, lower the load at once and take out the kink. This is important.

Best bet for precision rigging work is a chain hoist on the hook of a crane lift. Then when you get close to landing the load, further lift or lower only with the chain hoist, never with the crane itself. We learned this the hard way.

We were landing the water-end head of a large condenser on a chain hoist on the big hook. It was let down nice and easy, and two bolts got caught. But to line up rest of holes, we had to lift it up just a hair and tap it over a bit. OK so far, but an eager beaver in the gang signaled the crane man to hoist. He did — with a vengeance. One bolt sheared off. The chain-hoist hook slipped out of the eyebolt. The chain whipped through the air while the big plate slid down and hung on the other good bolt. We were lucky. No one was hurt. But it brought home two more lessons:

1. Always mouse a hook if there is the slightest chance that the load might slip off.

2. Have one responsible man, and only *one*, give the necessary signals to the man handling the crane.

Halfway Measures Make Good Incineration Impossible

An old boiler and a growing combustible-waste disposal problem seemed to be made for one another. Here's how (1) the temptation to take the easy way out boomeranged, and then (2) the steps we took to return to sound fundamentals finally produced a topnotch, workable incinerator

By **MELVIN EVANS**, *Chicago, Ill.*

► OUR PLANT kept turning up heavy loads of paper, resin, hair, wood scraps, shavings or what have you, in the daily course of doing business. Like many other plants we got rid of this rubbish somehow—usually the easiest way out. Finally we recognized the problem of waste-matter disposal was getting no better fast, and steps had to be taken to bring it under control.

We had an old low-setting boiler, crowding 50 years of age, quite a little distance from the main plant buildings. It looked like a natural for our problem. We pulled it out of service and added a dutch oven. That, we felt, would do the trick. With this arrangement we planned to burn all our refuse and salvage some low-pressure steam.

Right from the start the scheme backfired. We found any steam generated would be costly because licensed operators had to be assigned to the unit: firing was intermittent and heavy. What was even tougher to handle was our stack-discharge problems. Flames were shooting out the 75-ft stack! Ash and spark emissions were a sight to behold, and enough to throw the fear of the hereafter into our neighbors. Refractory replacement and stack repair were terrific. Finally, the drums, tubes and headers fell in and severely damaged the walls. We just had to do something.

Incinerator Selection. Best starting-off point was a check on the incinerator equipment available. There seemed to be no accepted standards, but the Incinerator Institute of America and the Air Pollution Control Assn came closest to agreement.

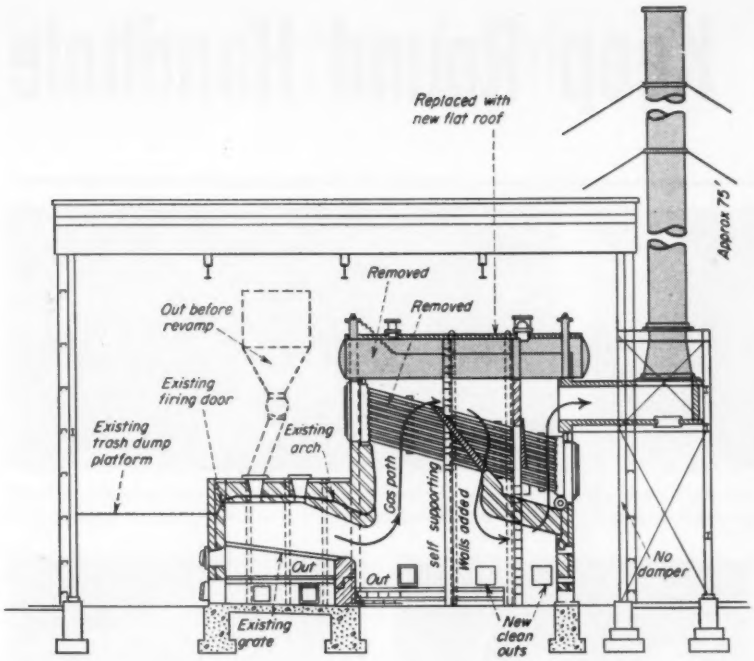
Basis for satisfactory incinerator solution and operation, we found, is the proper analysis of the waste and refuse you've got to burn. There are six major classes of waste fuel, ranging from mixtures of garbage with rubbish to by-product wastes. Our mixture—paper, resin, wood scraps, shavings—came closest to what experts describe as Type 3 waste fuel, or rubbish, consisting of dry, combustible waste with a moisture content not exceeding 25% by weight. The term rubbish means paper, rags, scraps, cartons, floor sweepings. The 25% moisture represents normal moisture content in dry-waste materials. Type 3 fuel is based on not more than 6500 Btu as fired per lb, having 10% ash and 25% maximum moisture.

Next, we observed that the large-scale industrial incinerator, designed for the fuel we had and the load we expected, looks somewhat like a brick-set boiler from the front. It has hinged and guillotine-type charging doors, on the end or on either side of the firebox depending on where the incinerator is put and the room around it. Clean-out doors go in below the grate level as well as at the bottom of the various chambers.

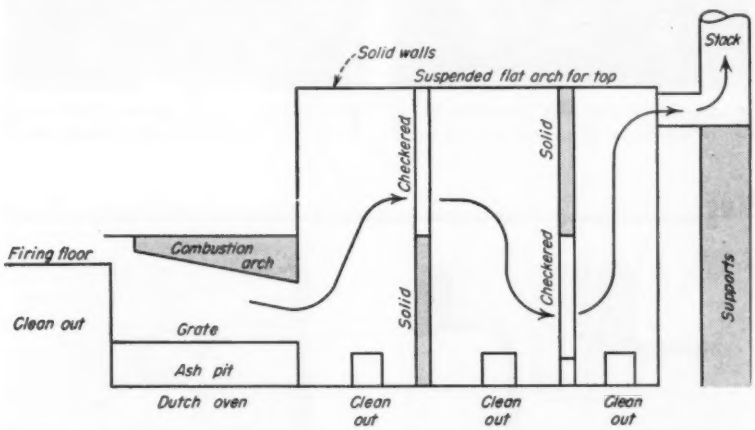
It is quite normal to find the incinerator divided into primary and secondary, or smoke-burning chambers. Some designs add a third or flyash settling chamber, see "after" sketch.

With a waste fuel such as we had, readily combustible, a grate with 40-50% air openings is considered just about right. Next, you should have a secondary chamber of baffled brick or with refractory lining, where the combustion products leaving the primary chamber have time to burn completely. If the burning is complete enough, you may even lose enough of the heat in the gas in a third chamber so you won't damage the usual chimney.

You see, we felt the old chimney would be a natural for any incinerator. But we had to take some steps to protect it against the high-temperature gas any incinerator puts out. It runs much higher than the usual boiler flue gas. In fact, it gets up around 1500 F. So unless the flue, breeching, chimney or incinerator chambers were large enough to let this hot gas dilute and cool to a safe temperature level, we would have



BEFORE Simple, straight-tube, baffled boiler about 50 years old looked like a natural for burning rubbish, so we added a small dutch oven to help



AFTER This streamlined, converted layout, properly baffled and checkered, gives an ideal incinerator with flyash separation, and low stack-gas temperature

to abandon the old stack as unsuitable.

Once we got to thinking of salvaging our old boiler plant we decided not to stop with the chimney. Instead, the whole layout came in for study with the idea in mind of making our own incinerator. The following tells the story.

Boiler Conversion. The "before" sketch shows what we started with. The dutch oven, about 15 ft long by 10 ft high, is as wide as the boiler front. We pulled out drums, headers and tubes, and put in full-width, self-supporting, checkered baffles to classify the ash and provide a better heat dissipation.

We divided the furnace length into thirds. Then, at about half the furnace height, we cut the solid wall setting at the first third of the furnace. On top of this went the first-pass, self-supporting, checkered baffles. Then at the next or second-third point, we did the reverse. We started with the checkered baffles from the furnace floor, ran them up about half the furnace height, and finished off with a solid wall.

Our last third of the furnace area could be sized, then, to take care of the decreasing volume of gas to meet a maximum gas velocity of 1500 ft per minute. The "after" sketch shows the completed job.

Incinerator Operation. We start up our incinerator by sprinkling oil on a bed of waste paper. Flashback is nil. In fact, our stack is actually too high for the job. But, fortunately, the baffling adds enough resistance to the gas flow to hold down the draft to the proper control point. Operation, so far, has been good and we feel there's no need to put in any dampers at the breeching. See "after" sketch.

We bring in trash to the incinerator firing level and feed it in about 50-cu-ft lots to the incinerator. Operator pushes the waste onto the front of the grate as fast as he can. Combustion is excellent. Maintenance costs have dropped down to an insignificant amount. Stack temperatures are down where they present no special problems. Emission is not noticeable to anyone. In fact, we need no arrester at that level at all. Labor for cleaning out the ashpit is well below the old setup. Our combustion rates are much higher and we need a lot less labor. For our money, we've got a crackerjack incinerator at very little cost.

Incinerator Details. Actually, if you're facing a growing rubbish-disposal problem—and who isn't?—you'll find it smart policy to plan for a large-scale or industrial-type incinerator. Starting from scratch there are some definite advantages you can build into your layout.

First and least obvious is selecting the right place to set up the incinerator. Modern designs are no eyesore and you needn't feel you have to get them out of sight on that score. Your major consideration at this point ought to be convenience. The easier you make it to get refuse into the incinerator, the better it will be. As an example, if you spot it right near the major waste producers, you will have fewer handling problems to lick.

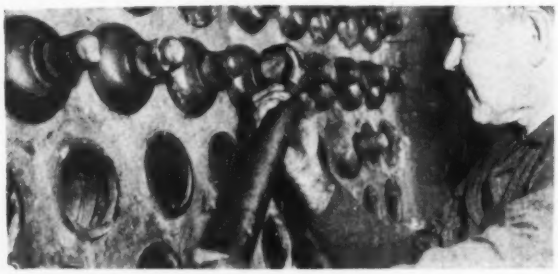
Next in order is feeding method. If your charging method or way of feeding the waste onto the grates is the best for your class of refuse, this operation should be no headache. Dry refuse lends itself to a feed system like the one we use. Garbage or wet material is a different story.

Sizing is the third advantage you want to include in your original selection. Remember, incineration is seldom a continuous operation. In some instances the whole day's collection is burned within a few hours. So sizing has to be based on burning rate rather than on a day's total. By the same token, allow time for clean-out and stoking. At lower capacities a damper installation in the breeching to the stack helps regulate overfire drafts for adequate combustion.

OPERATORS' NOTEBOOK 63

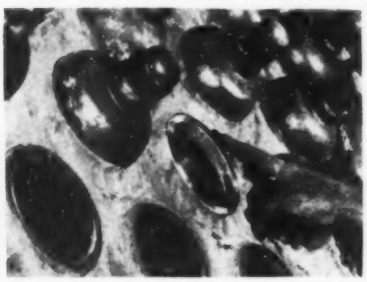
Keep Round Handhole

Face Seat and Plate

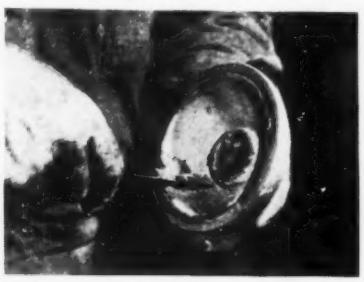


1 With boiler drained, remove nut from handhole plate assembly, so tubes can be turbined, inspected or even replaced

2 Loosen nut only few turns, then remove assembly by tilting as shown. Gaskets are not now used on these plates



5 Check the ground joint for smoothness so the steaming boiler will not leak



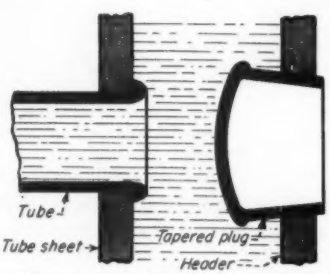
6 Remove sludge and scale from inside of the cap with scraper ground to fit

7 Grind cap joint against disk bench grinder that also has flexible shaft

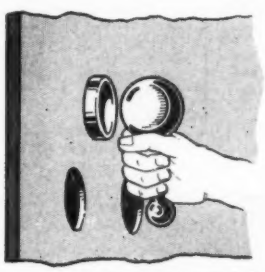
Use One-Piece Tapered Plug

TAPERED PLUGS ARE SIMPLE, HANDY

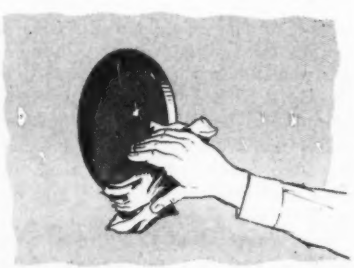
- **One-piece tapered plugs can be used on boilers having master handholes on the headers as shown**
- **These large holes are needed so plugs can be placed inside, between the header and tube sheet**
- **Boiler's pressure holds plugs firmly in place. Then header can be insulated to keep heat from escaping**



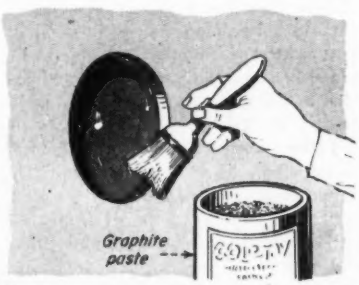
1 Tapered plug fits into hole opposite tube, with room to clear tube sheet



2 Remove plug by tapping lightly with brass maul. Hit caps in center only



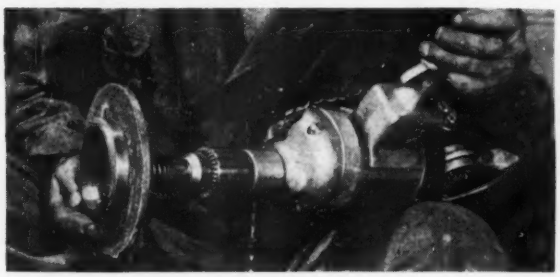
6 Before replacing plugs, remove grease by carefully wiping joint with a rag



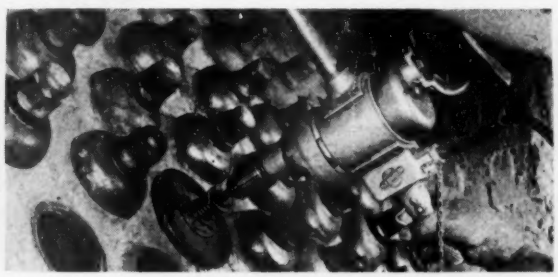
7 Coat tapered hole contact-surfaces with an even coat of graphite paste

Plates From Leaking

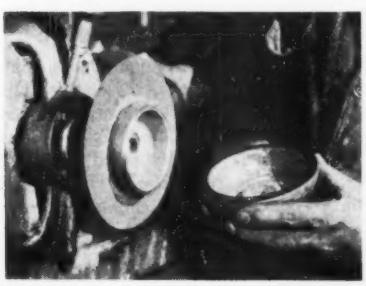
By STEVE ELONKA, *Associate Editor*



3 Disk with grinding cloth held on flexible shaft now grinds header joints smooth. Flexible shaft is important here

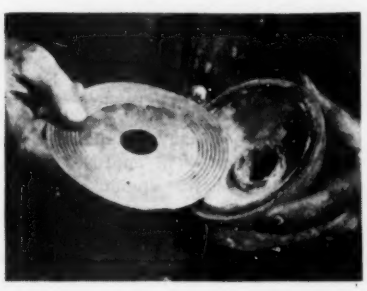


4 Hold disk firmly against joint while grinding. Spring prevents uneven joint if electric drill isn't held perfectly square

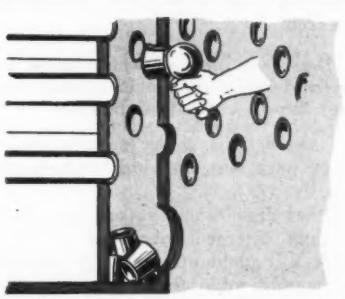


8 Finished job is smooth, level joint that will mate perfectly with header

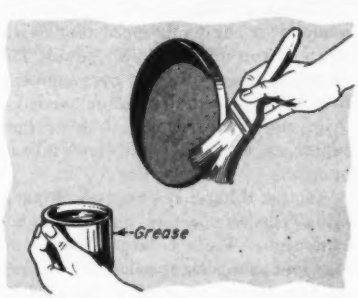
9 Coat ground joint lightly with graphite paste so it seals joints tightly



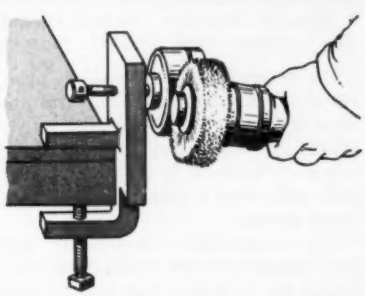
10 Corrugated-metal gasket not needed now that both joints are ground



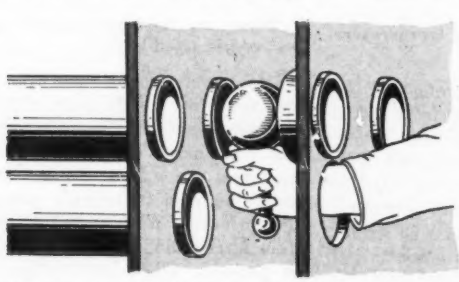
3 Plugs fall between header and tube sheet. Remove from master handhole



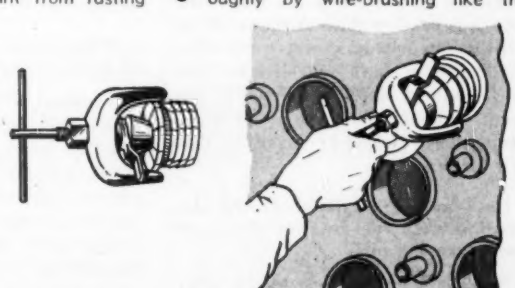
4 Grease contact-surfaces of tapered holes to prevent joint from rusting



5 Clean tapered walls of plugs thoroughly by wire-brushing like this



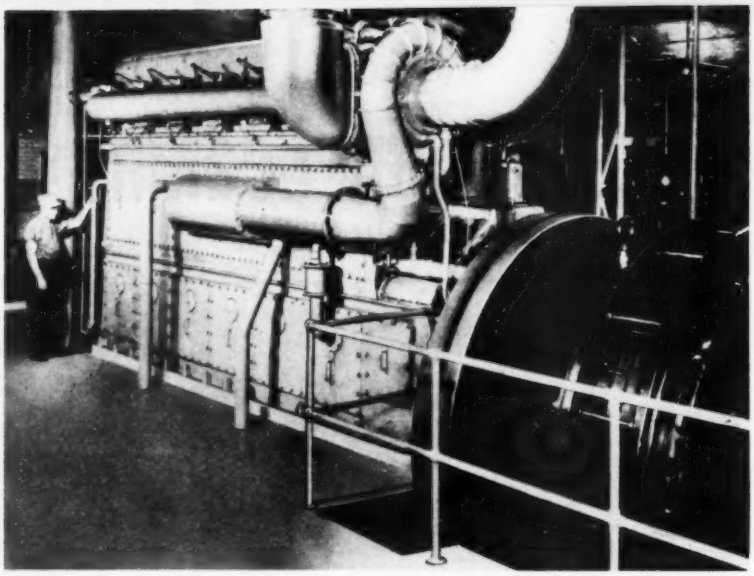
8 Insert plug immediately after removing grease. Give it a slight twist so it seats well. Then tap firmly in place



9 Fill boiler and raise steam to 100 psi. If plug weeps, tap header around plug. Pull up on plug with tool shown

18 DIESEL Q and A

By JOHN BAKER
Chief Diesel Engineer



MODERN supercharged diesel gives efficient power to City of Menasha, Wisconsin. Operating know-how will keep this unit running for many years of very hard service

1 Should bearing clearances be same in 4- and 2-cycle engines?

Some manufacturers have found that reducing 4-cycle engine bearing clearances by almost 50% improves engine operation. A 2-cycle engine has no reversal on main or crankpin bearings. But a 4-cycle engine has inertia forces at higher speed on the exhaust stroke that reverse the load. That causes an impact condition that breaks down the oil film locally. Proper engine alignment and closer bearing clearances in modern engines reduce bearing troubles on 4-cycle engines.

2 How do the new, vertical, radial diesel engines work on gas?

For burning gas, these engines operate on spark ignition at about 260 psi. Each cylinder has a gas-inlet valve, above the scavenging ports. These valves are actuated by rocker arms and push rods from a cam on crankshaft's upper portion.

Valves introduce low-pressure gas into cylinders in path of incoming scavenging air to assure thorough mixing. Two spark plugs are in a vertical plane. They fire at different crank angles, before top dead center. Amount of gas delivered to cylinders varies (depending on load on engine) controlled by valve in gas header that's connected to governor. Volume of scavenging air is also proportioned to load by throttling blower's suction.

3 Does fuel oil in a diesel cylinder stop burning when fuel injector closes and stops spraying oil?

No. There may be considerable afterburning after the injector closes, although theoretically there is none. After-burning depends on ignition temperature inside cylinder, how well fuel is atomized, other factors.

4 Why don't diesel engines have eccentrics instead of cams to open and close the valves?

Eccentric operation is too slow for a diesel engine. The cam, on the other hand, gives quick or slow opening and slow or quick closing, if desired, depending on shape of cam.

5 What is meant by term "torque at firing speed"?

Torque at firing speed is torque demanded by engine at speed that engine starts to run under its own power. This torque is largely used to overcome friction, but also includes torque needed to drive engine auxiliaries, such as fans, supercharger, fuel, water and lube-oil pumps.

Another thing that increases torque at firing speed is effect of compression and expansion. While a large part of energy put into compression is regained on expansion, recovery is not 100%. So additional torque must be supplied to make up these losses.

6 What is the dewpoint temperature of diesel exhaust gases?

Dewpoint of internal-combustion engine exhaust gas is usually from 110 to 130 F at atmospheric pressure. At 500 psi it is about 300 F. Dewpoint temperature may be much higher, depending on atmospheric relative humidity. Temperature also depends on exact composition of combustion products.

7 Where do knocks occur in diesels, and what are some causes?

Knocks often develop in large bearings, valve gear or inside diesel cylinders. Bearing knocks come from too much clearance. This may be from gradual wear or overheated bearings, after bearing metal fails. Valve gear may knock because of excessive rocker-arm roller clearance. Also from worn or broken rollers or from sticking valve stems.

Knock inside the cylinder is from too-early injection. Also from excessive spray-valve lift at low speeds, spray air pressure too high, or from stuck piston rings. Another knock might be from water in cylinder if liner or head is cracked.

8 Detergent oils are widely used in internal combustion engines today. Do they improve life of all engines?

Some designs, under certain conditions, work best with highly detergent oils.

Other diesel engines work best with medium detergent - disperant activity, while still others of conservative design and rating work about same as with good, straight mineral oils. So it all depends on type of engine.

9 What are best safeguards against fuel-nozzle troubles?

Most nozzle troubles are from dirty fuel and from nozzle overheating, not from breakage. First step is to use clean fuel. That means centerfuging or filtering. Next use a 2- or 3-stage filtering system between fuel-supply pump and injector pump. While engine is running, drain filters and strainers of water at set periods. When overhauling injection pumps and nozzles, keep foreign particles out of equipment.

SEAL-TYPE piston rings, *upper grooves*, have kept the hot gases from blowing by

10 Older slow-speed engines were operated with cooling-water discharge and lube-oil discharge temperatures of 100 to 120 F. Today, engines often run with water and oil temperatures 180 to 195 F. Is this good practice?

Low-water temperatures of 120 F are below dewpoint. That causes lube-oil sludging problems. High cooling-water temperatures give better fuel economy. But there are often other problems because of too high temperatures.

Raising lube oil above 150 F often increases oxidation rate of oil. With additive oils, inlet-oil temperature of 140 F and outlet of 160 F is good practice. Keep water temperature above lube-oil temperature if engine has air-cooled pistons. Then cylinder will expand more than piston, thus holding clearance between piston and cylinder right. Run with water inlet of at least 160 F and outlet of 170 F. But keep these two temperatures within 15 degrees, if possible.

11 What are some common faults to look for in defective fuel nozzles?

Look for incorrect spring tension. Perhaps next most common fault is fuel injector valve not seating properly. Check for stuck nozzle valve-stems and for erosion or grooving along stems. Next inspect orifices for defects. Often nozzle tips are clogged or carbonized. Easiest to find are broken springs or broken valves.

12 When diesel bearing fails, is it better to replace one pair or should you replace complete set?

Some manufacturers recommend replacing bearings in sets. Remove a failed bearing at once, or it may cause other parts to fail. Reason is that bearings are inexpensive compared to crankshafts and other large parts. Best answer to replacing bearings in sets is knowing your engine. Past experience might indicate that only failed bearing need be changed.

13 Do piston-ring combinations have to be changed as an engine ages?

Some firms say yes. Changing to different ring combination as an engine ages might be an advantage, especially on larger engines.

While first set of rings is used, liner wear tapers gradually. There is also groove wear. Study engine performance. If oil consumption is high or engine output low, correct by using right rings for problem when replacing. There are many ring combinations to solve various problems.

14 What type oil filters do diesels have and do they remove all dirt from oil that enters or is produced by the engine during normal operation?

Filters are usually either full-flow or shunt type. One passes all oil through, while other bypasses part of oil. Full flow must be large to handle the volume, while shunt flow can be much smaller.

No filter can remove dirt unless it reaches filter. For example, some dirt settles in sump and remains there. Usually there is little settling if engine is operated normally. Only way an engine can be clean is for filter to remove all dirt. Fuel-flow filtering is popular today as it removes dirt sooner.

15 What is main cause of noisy combustion in a diesel engine?

Chief reason is high rate of pressure rise in cylinder during early combustion stages. During these early stages, increase rate should be about 30 psi per degree of crank angle. Experience shows higher rates usually cause a "rough-running" engine. Best way to know rate of pressure rise is to take "jerk" or "pull" cards. Do this by pulling cord of indicator drum by hand during compression-firing revolution of crank. This cannot be done on high-speed engine.

Such a card shows compression and firing pressure as a peak at top dead center of card. Line starts at zero degree crank angle at bottom center and rises very gradually to about 60 deg. Then rate of rise is more rapid until peak is reached at top dead center. On quiet engine, look for smooth combustion line with about same slope or pressure rise per degree of crank angle as the compression curve. Compression curve is lower part of this curve just before fuel is injected.

16 What determines the lubricating-oil consumption of a diesel engine?

Mechanical condition of engine is important. If piston rings are in poor shape, too much oil is pushed up the cylinder walls and so is lost. If rings fit poorly or are stuck, or if liner is tapered badly, hot combustion gas blows past rings and burns lubricating oil off the liner and piston. These are only some of the more common causes.

17 What are some of main causes of corrosion wear in engine cylinder?

Corrosion wear in diesel cylinders is always present. Under some conditions it is much greater than abrasive wear. Carbonic, sulfurous and sulfuric acids form when fuel oil is burned. These are most serious causes.

Best way to fight them is to use corrosion-resisting materials for cylinders and piston rings—and pistons. Then keep jacket cooling water high as possible and use lube oils with additives to fight your condition. High sulfur diesel-fuels make corrosion a constant problem in any type engine.

18 If your 4-cycle engine's camshaft is removed and the timing completely lost, how do you time the engine in a hurry?

A 4-cycle engine's intake valve opens from 10 to 20 degrees before piston reaches top dead center (TDC) and exhaust valve closes from 10 to 20 degrees past TDC.

For quick timing, jack piston of any cylinder to TDC, with the camshaft gear out of mesh. Then turn camshaft until the inlet valve just starts to open and the exhaust valve just starts to close. Mesh gears while camshaft is in this position. Timing is usually correct to one gear tooth, which is close.

Did You Know . . .

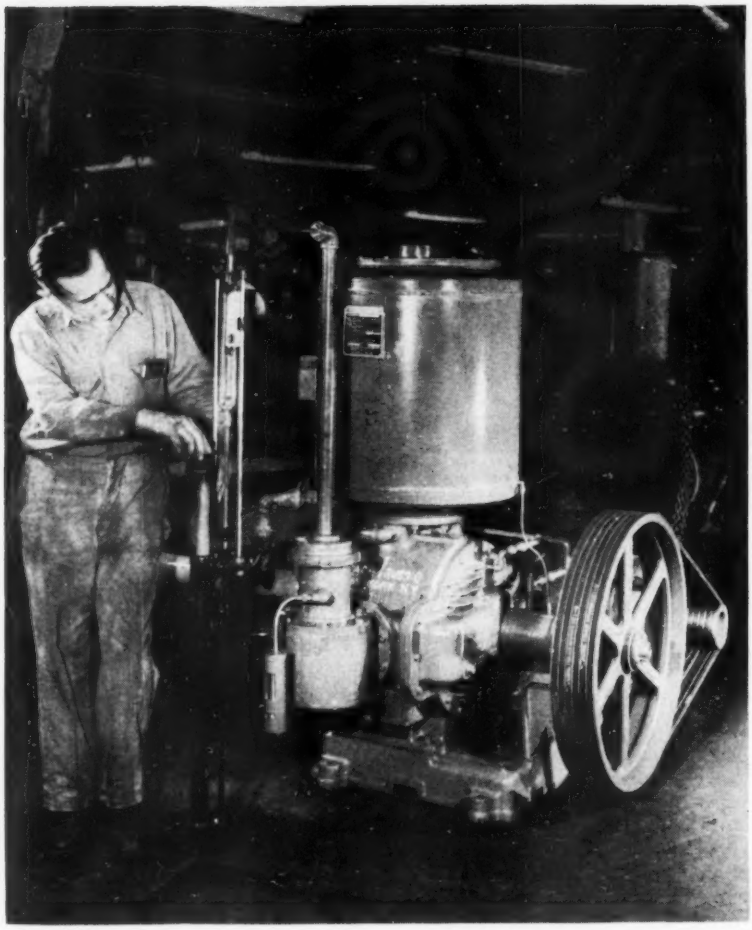
● 15c sent to U.S. Government Printing Office, Washington 25, D. C., will bring you a copy of National Bureau of Standards' Circular 506, *Automotive Antifreezes*. This gives about all the info you want on this subject, whether for stationary engines, trucks, or your own car.

● In first 11 months of 1952, Class 1 railroads installed 2840 diesel-power units. On Dec 1, there were on order 748 diesels, 19 gas turbines, 17 steam and 10 electric locomotives. "Good-by" steam engines.

Dehydrate Your Freon System Now

- *Moisture balls up temperature, corrodes inner parts*
- *Keep air out when repairing to prevent moist air*
- *Vacuum pump, vacuum indicator are needed for top job*
- *Cobalt in the silica gel remains blue when all the moisture is out of system*

By DICK GODFREY
Refrigeration Engineer
John H Dulaney & Sons



OPERATOR reads vacuum of one mm abs press. on McLeod mercury gage connected to high-vacuum pump, dehydrating big industrial units *Photo, courtesy Beach-Russ Co*

► PUBLIC ENEMY NO. ONE in Freon system is "moisture." This is always the unanimous vote of designers, operating engineers and service men. And they should know.

How does this trouble-maker get in? Moisture may be left in the system after erection, it may enter with air through a leak, or it may get in when system is opened for repairs. But regardless of how moisture gets in, it causes plenty of trouble.

At worst, it can gum up a system completely so you can't maintain temperatures. At best, moisture causes corrosion of compressor valves, expansion valves, shaft seals, etc, and it shoots maintenance costs way up.

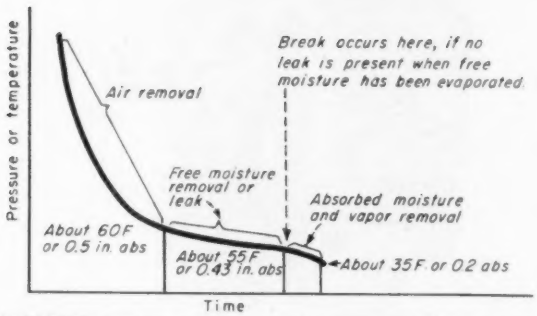
Removing moisture from a new system is a very important step. No reliable contractor fails to do it. Time to remove moisture in a new system is after leak-testing the completed piping system. How? First pull a vacuum of 0.2 in. absolute pressure (29.8 in. of vacuum) in the system with an ambient temperature above 40 F. Use a high-vacuum pump. When this pressure is reached, all free moisture will have "boiled" into water vapor. And the moisture will have been pumped out by the vacuum pump so your system will be dry. Pump in photo creates two millimeter absolute for dehydrating.

Only equipment needed for dehydrating is a good vacuum pump and a vacuum indicator. If you have no indicator, you can easily make one on the job, from a large test tube, an accurate thermometer, some wicking, corks, copper tubing, and paraffin, sketch. Pack the test tube into a container with insulation as shown. Take care that indicator is perfectly air-tight and handle it very gently. Use paraffin to seal around tubes so it is airtight.

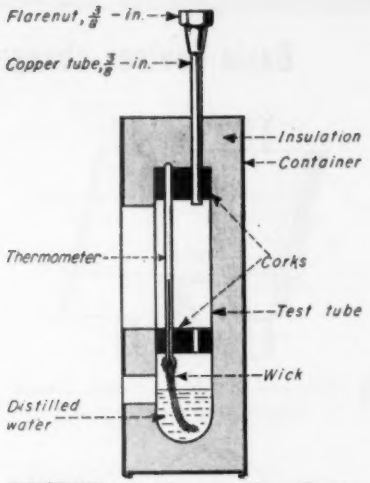
New System. To dehydrate a new system, connect a tee to the charging connection, sketch. Connect vacuum pump to one branch of tee with copper tubing. Attach vacuum indicator to other branch, with shutoff valves in each line. Open all valves in system *except* compressor service valves, vacuum indicator valve, and valve to the high-pressure gage.

Compressor is usually dehydrated at factory, and vacuum will injure high-pressure gage if it's not a compound gage. Open the indicator valve only to take readings. If valve is left open, water in test tube will boil off. Then you will be troubled with replacing the water often. And pump will have more water vapor to handle. After opening valve, allow five minutes for conditions to steady before taking reading.

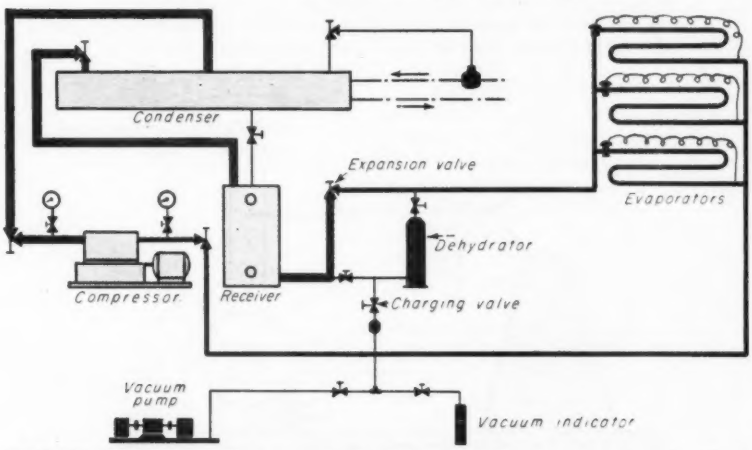
Start vacuum pump. If 2-stage, operate pump parallel at first. As pressure


Pressure or temperature
Break occurs here, if no leak is present when free moisture has been evaporated
Air removal
Free moisture removal or leak
Absorbed moisture and vapor removal
About 60 F or 0.5 in. abs
About 55 F or 0.43 in. abs
About 35 F or 0.2 abs
Time

ABSORBED moisture and vapor are removed only when pressure in system is down to 0.2 in. absolute, or 29.6 in. of vacuum



MOISTURE is out of system when all water boils out of this homemade indicator



VACUUM PUMP and indicator are hooked into charging line. If system has been flooded from condenser leak, you have to break low points in lines, drain out water

in system is reduced, boiling point of water within it lowers until finally all moisture is removed. When 55 F (0.43-in. abs) is reached, change pump to series operation (if that type); pump until 35 F (0.2-in. abs) shows on vacuum indicator. Then close pump valve and stop pump. Hold vacuum for about five hours, but check hourly by opening valve to vacuum indicator. If vacuum holds, disconnect pump, connect Freon cylinder, and break vacuum with Freon.

If you follow above steps, your system will get a good moisture-free start in life. And that pays dividends. Keep system in this dehydrated condition by taking extreme care to prevent air from entering. For example, when opening a system for repairs, be sure to purge all open parts with Freon gas, to expel the air before closing system.

Most operators think nothing of hooking charging lines to system without expelling air in line. Always purge charging lines with Freon before connecting into the system. Keep on your toes by repairing leaks promptly, as soon as you find them. That's very important in systems operating below atmospheric pressure on the low side. After you find a leak and repair it, run the refrigerant through the dehydrator (dryer) for some time.

Water often gets into a system by accident. Dehydrator cannot remove all water. Some can be removed by cutting a service dehydrator into the liquid line and changing the cartridges often. But when a condenser tube or water-chiller tube lets go, it takes more drastic action. This is especially true where water pressure is higher than normal refrigerant pressure.

Best job in such cases is done by blowing off the contaminated Freon charge. Then repair leak and use vacuum pump as in a new system. But this is expensive. Not only is refrigerant charge lost, needing costly replacement in large systems, but labor also runs high.

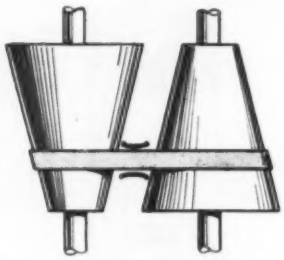
Amount of vapor handled by vacuum pump is small, so cut system at all low points and drain water and oil from those sections. Then repair these cuts. It's also important to remove all possible oil from the system. That includes the compressor crankcase, as boiling refrigerant out of oil with vacuum pump is a long process.

Less costly repair job, and almost as effective (if properly carried out), can be done with a "system washer." There are several models and makes on the market.

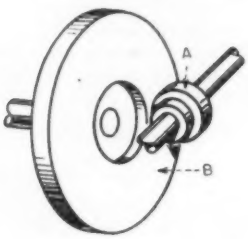
After repairing the leak, remove cages from the expansion valves and start the compressor. Circulate liquid refrigerant through the low side and boil it off in the washer by hot discharge gas. Water and dirt then fall to the bottom, where they may be drained off. Moisture vapor is then absorbed by the silica-gel bed. Continue this circulation, and change the silica gel often until all traces of moisture are removed. You will know this point by adding grains of cobalt to the silica gel. Cobalt remains blue when all moisture is out.

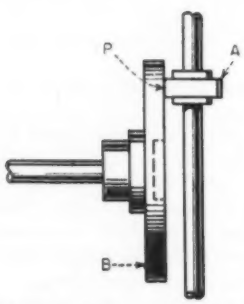
I haven't mentioned the various "liquid dehydrants" now on the market. Reason is that I don't claim to be chemist enough to evaluate the claims made for them by their manufacturers. But as far as I know the leading refrigeration and air-conditioning equipment manufacturers have never advised using them. So you had better check for yourself before going overboard.

Basic devices change constant-speed input to variable-speed output

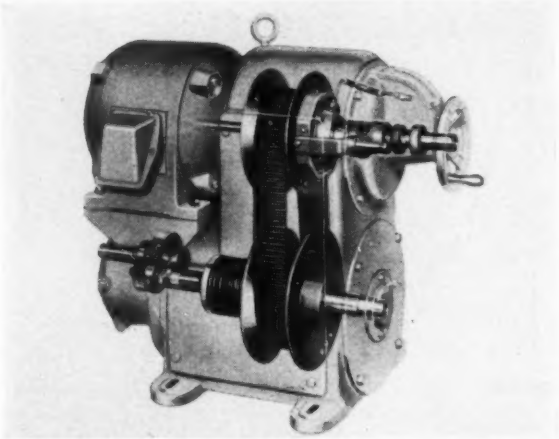


1 Cone-and-belt drive principle is used in modern commercial transmissions

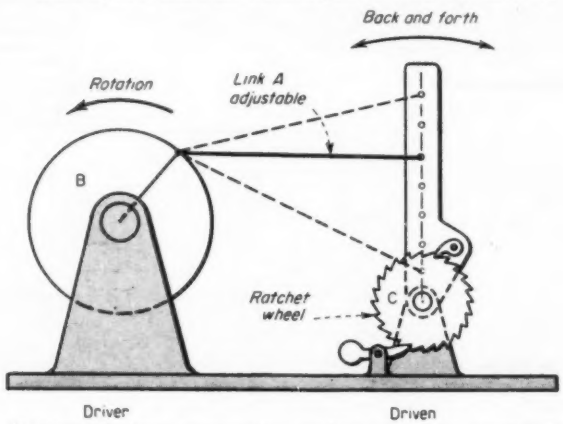




3 Disk-and-roller unit has an infinite-speed range, transmits limited torque



2 Commercial variable-speed drive has built-in motor and a hand wheel to make smooth changes in the sheave diameters



4 Variable-throw transmission produces pulsating rotation in driven member when the driver rotates at a constant speed

Mechanical Variable Speed Transmissions

By **W L BYLER**, *North Wales, Pa.*

• Here's a roundup of facts on the basic forms and principles of mechanical variable-speed transmissions. You'll welcome this detailed dope on the various ways to operate the same machine at different speeds

• This is the first in a series. Future articles will report on how today's manufacturers put these principles to good use

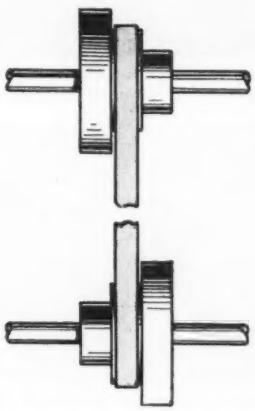
► THERE ARE three basic types of mechanical variable-speed transmissions: cone-and-belt, disk-and-roller, and variable-throw designs. Multi-speed transmissions—change gears and step pulleys—are not variable-speed devices in a strict sense. Their speed ratios are fixed, and no in-between variation is possible. Here's what you need to know about these five types:

Cone-and-belt type, Fig. 1, was the original variable-speed transmission. It consists of two symmetrical cones mounted on parallel shafts. Sum of the two diameters in any plane perpendicular to the shafts is a fixed dimension. Shifting a leather belt back and forth along the pulleys provides an infinitely variable-speed range between the high and low limits possible with the diameters used.

Belt stays put after initial creep pulls it tight. Creep is due to belt trying to find the maximum pulley diameters.

Types of Mechanical Variable-Speed Transmissions

Principle	Engagement	Torque characteristics	Torque range	Speed change	Speed range	Remarks
Variable-speed						
1. Cones and belt or ring	Friction	Varies inversely with speed	Limited by cone diameters	Stepless	Limited by cone diameter	Good control, speed and torque range. Good usage
2. Disk and roller	Friction	Constant	Limited by roller diameter	Stepless	Unlimited	Infinitely variable. Low power
3. Variable throw	Positive	Varies inversely with speed	Limited by inertia and strength of parts	Pulsating	Unlimited	Low power. Limited use
Multi-speed						
1. Change gears	Positive	Varies inversely with speed	Wide. Limited for any set	Stepped	Wide. Limited for any set	Precise speed control
2. Step pulleys	Friction	Varies inversely with speed	Not wide as (1). Pulley diameters limit	Stepped	Not wide as (1). Pulley diameters limit	Poor speed control



5 Step pulleys use same belt length for each step, transmit power by friction

Cone-and-belt transmission is crude and does not serve too satisfactorily when used the way it is shown in the illustration, Fig. 1. Belt creep and slip cause power loss and unpredictable speeds. Moreover, power that can be transmitted is low because belt must be relatively narrow. Theoretically, there should be only line contact. In addition, belt life is short and wear on the cone faces eventually destroys usefulness of the drive.

Despite these disadvantages, you will recognize this principle as basic to virtually all the designs of mechanical variable-speed transmissions in successful industrial operation today. Photo, Fig. 2, shows one popular type.

Disk-and-roller is another pioneer form of variable-speed transmission. It is a right-angle drive, and the speed ratios can be varied at will. Roller *A*, Fig. 3, is mounted so it can slide in an axial direction parallel to the face of disk *B*. Speed ratio depends on position of roller on disk. There is usually a depression in center of the disk, forming a neutral or no-drive area. When you move roller past center, disk rotates in the opposite direction.

Pure rolling contact is desired, but occurs only when roller *A* has no thickness. You cannot approach such a condition on a practical machine unless the power transmitted is quite low. Actual rollers have line contact, with pure rolling contact only at point *P*, center of the roller. So there is a great deal of sliding at the roller sides, causing rapid wear.

Disk-and-roller transmission is sometimes used almost exactly as illustrated for instrument and other limited-torque applications. It provides infinite, smooth-speed variation from forward through zero to reverse.

Variable-throw is the third basic type of variable-speed transmission. See Fig. 4 for fundamental principle. When crank *B* turns at constant speed, ratchet-wheel *C* has pulsating rotation. Moving adjustable link *A* up or down on the oscillating arm varies the degree that ratchet wheel *C* rotates for each full turn of *B*.

Mounting several units with overlapping phases on each shaft will produce reasonably uniform rotation at *C*. Transmissions constructed on this principle are sometimes used for low-torque applications today.

Change gears are common multi-speed transmissions. Basically, they consist of simple gears with a clutch arrangement for shifting to different fixed ratios, with no in-between variation. Change gears find wide use on machine tools, motor vehicles and other equipment needing only a few exact speeds.

Step pulleys, Fig. 5, are designed so the same length of belt is required for any pair of steps. They are multi-speed transmissions — you can obtain only specified speed ratios. To shift belts, operator must stop the drive. The friction driving efficiency is low, and speed control is poor. Step pulleys are occasionally used on today's simpler and lighter machine tools, but have largely been replaced by variable-speed, motor-driven pulleys, or other variable-speed transmissions.

Terms Defined. In a later article we shall discuss how manufacturers have adapted the principles shown in table, above, to produce our modern variable-speed transmissions. But first, let's unscramble a few terms.

A *transmission* is a mechanical device that transfers power from the prime mover to the driven machine. Variable-speed transmission does the job with variable speed and torque conversion. A *drive* is a transmission complete with prime mover.

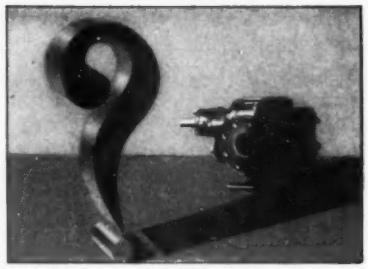
Sometimes the terms multi-speed, infinitely variable-speed, and infinite speed range sound like double-talk. *Multi-speed* transmissions offer two or more speed selections in fixed ratios or steps, and are not truly variable. *Infinitely variable* transmissions change their speeds in unnoticeably small steps within some definite range, such as 6 to 1. *Infinite-speed range* means that the transmission can go down to or through zero rpm to reverse. Transmission must go through zero rpm for an infinite-speed range.

Torque converter means that torque increases when speed goes down and vice versa. All mechanical transmissions are torque converters within their efficiency limits and strength of parts.

How to Use Rotary Pumps

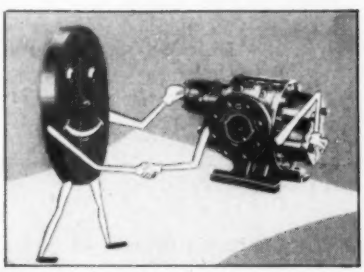
Excerpts from an excellent sound film on rotary pumps show some important pointers on applying rotaries in your plant. Read and study this info if you want graphic help on the job

Author: **ELLIOTT RICHMAN** *Director:* **F BARRY KOSS** *Art Director:* **KIP SHEPPARD**
All of Worthington Corp, Harrison, N. J.—Contact the author for the full show

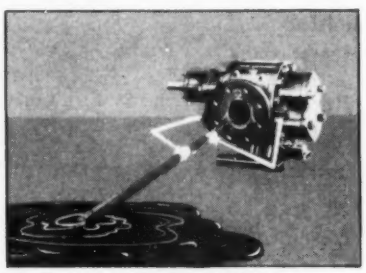


1 What's a rotary pump? This film will answer many questions about these...

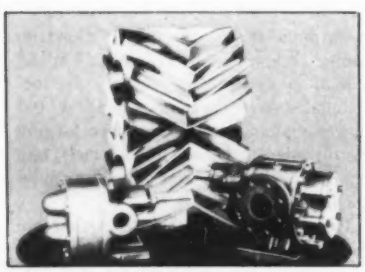
5 Where space is limited and simplicity appreciated. They have few moving...



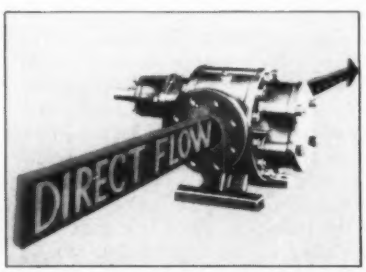
6 Parts, no valves, and are excellent where cost is a serious consideration



7 They are ideal for difficult suction conditions, as where a high lift . . .

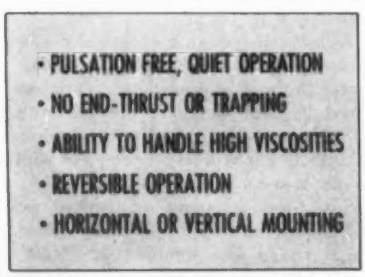


11 Double-helical herringbone gears in gear-type pumps are sturdy, rugged

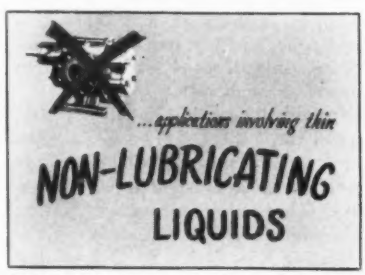


12 There is no chance of trapping the liquid between gear teeth and the...

13 Pump can handle the widest range of liquid viscosities met in service

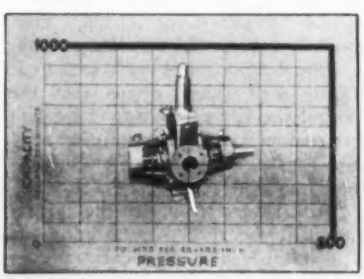

• PULSATION FREE, QUIET OPERATION
• NO END-THRUST OR TRAPPING
• ABILITY TO HANDLE HIGH VISCOSITIES
• REVERSIBLE OPERATION
• HORIZONTAL OR VERTICAL MOUNTING

17 And here are other advantages that make pump operation easier, better



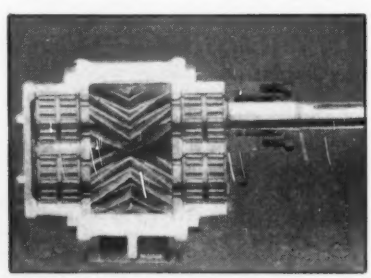
18 But don't use gear pumps for thin nonlubricating liquids nor for . . .

19 Liquids containing abrasive or corrosive materials that damage gears

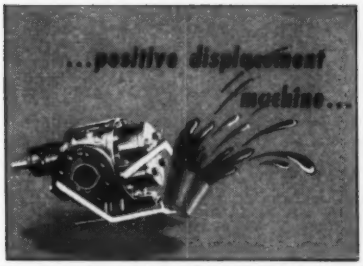


23 Vane-type rotary pumps handle up to 1000 gpm; pressures to 200 psi

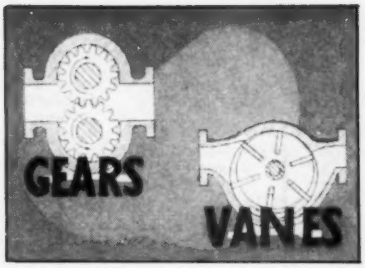
24 Here is how vane-type rotary pumps are available for your plant jobs



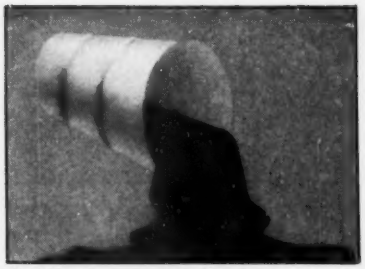
25 Mechanical seal furnishes leakproof stuffing box where this is needed



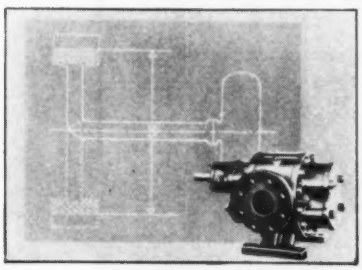
2 Positive-displacement machines that are like reciprocating units but . . .



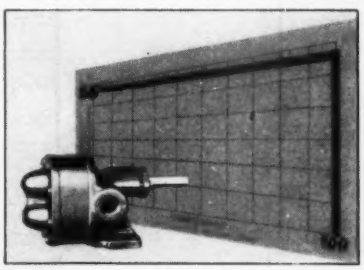
3 Of different design with close clearances, using gears or vanes as here



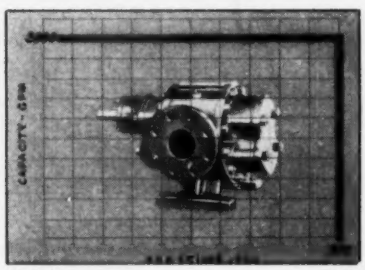
4 Use these pumps where high viscosity of liquid prohibits other types . . .



8 Or a self-priming pump is necessary. Also good for very low npsh condition

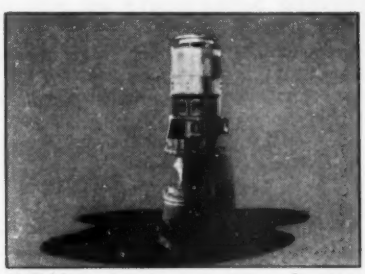


9 One pump design has capacities up to 56 gpm with pressures up to 100 psi

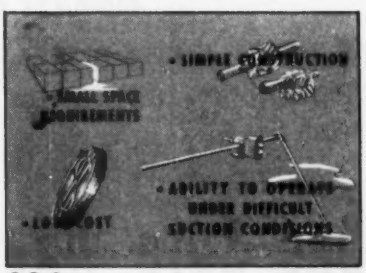


10 Larger pumps can handle up to 5000 gpm; discharge pressures to 500 psi

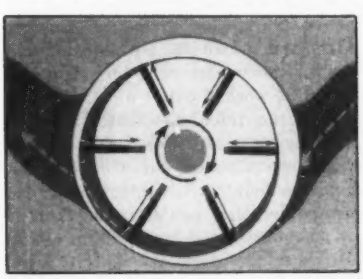
14 Herringbone-gear pumps can run in either direction without any change



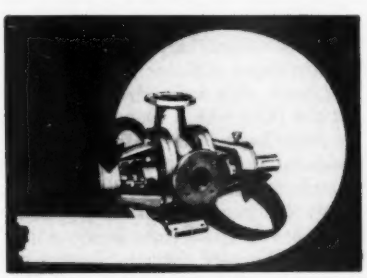
15 Vertical rotaries save much space in many applications on land and sea



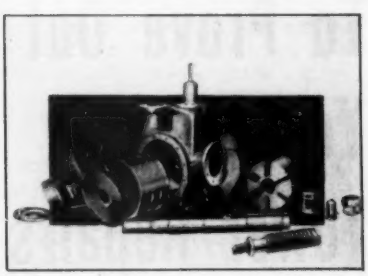
16 Summarized above are a few of the advantages gear pumps offer you



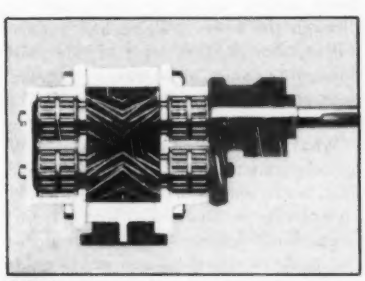
20 A sliding-vane pump with external bearings is far better, wears less



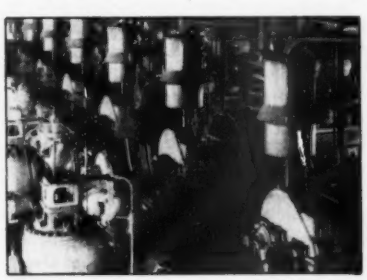
21 The bearings, as shown here, are separately lubricated, long-lived



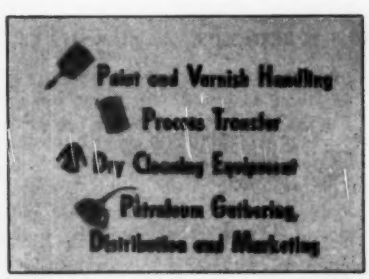
22 All wearing parts are replaceable when worn. The vanes are reversible



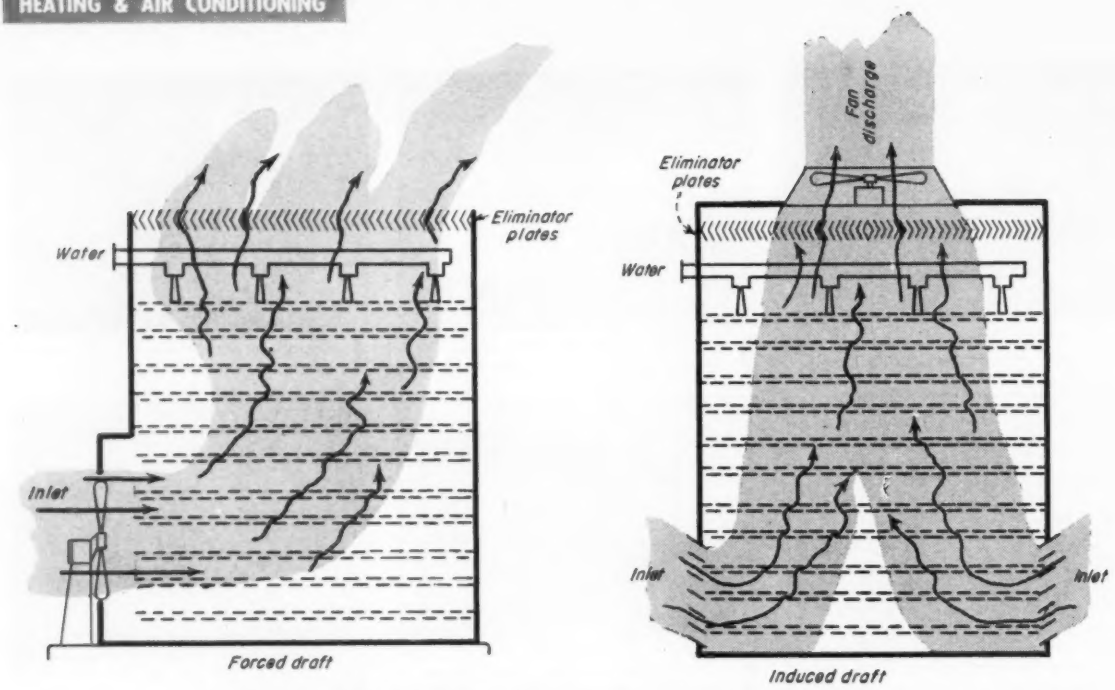
26 If there's danger of shaft deflecting an extra sleeve bearing is used



27 Among the many applications for rotary pumps are lube-oil handling



28 Here are some other jobs for them. Why not consider a rotary pump?



Simplest Possible Schematic of Basic Cooling-Tower Designs...

Easy-to-read sketches show moving air streams, plus the falling water, and all possible paths both can take with (1) forced-draft cooling tower, *left above*, and (2) induced-draft tower, *right*. Management can readily see the forces at work and appreciate the role of different elements, like the fill in the tower and eliminator plates across the top of both of the towers

One Sure Way To Prove Out Your Cooling Tower Repairs

By T W REYNOLDS, *Abbott, Merkt & Co*

► EVERY BUILDING OR PLANT owner who puts up a cooling tower expects it to perform with little or no trouble. After all, you need only expose hot water to air and it cools by itself. Nothing complicated there.

When you go to a mechanical cooling tower where you use a fan to speed up both air movement and cooling effect, it still seems fairly simple to top management. They can't see any reason for trouble here. In fact, if trouble does develop, they believe that operation is at fault.

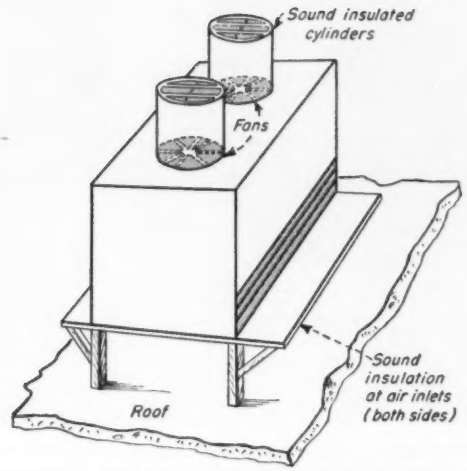
Recently, three sharply different problems developed with our cooling towers. Two were with induced-draft designs and the third with a forced-draft unit. We were having the devil's own time explaining the difficulties away, but fortunately we came across the two very simple sketches above. They proved to be the key to putting our finger on the trouble. We used them to show management what our trouble was, and why it happened. These sketches made cooling-tower operation understandable to them. Corrections we put in make up the two figures on the facing page.

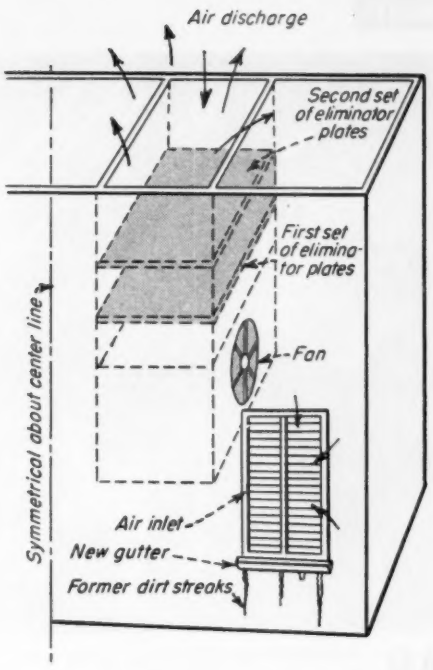
Let's tackle Case No. 1. It was an induced-draft unit located quite close to the main office buildings. Some of these buildings stand much higher than the one carrying the tower. I know—you can see the trouble coming. In this case, though, mist was no great problem. At least, nobody's complained yet. But office workers sure did raise the roof about the noise the induced-draft fans gave off.

Noise Problem. We got up on the roof and began our job by taking sound readings so we could tell just how legitimate a gripe they had. We found a noise level that averaged out at 80 decibels (db). When you compare this with a New York City street-level noise of 85 db, you see we had a problem on our hands. Some sort of sound-insulation had to be worked out.

With the aid of the sketch at right, on this page, we showed management where we thought our trouble came from—namely, air rushing in at the tower inlets and, again, at the fan outlet. Someone said we could probably also hear the noise the falling water made. We personally felt the rushing air stream would pull most of this noise away and it would be dissipated up through the tower. We've had experts tell us, though, that some of this noise does get out since noise waves can travel even against a moving air stream. But that only made the problem worse.

What we did was rig up two metal cylinders about 8 ft high. We put these, lined with waterproof sound-insulation, up over the fan, see left sketch, facing page. Each cylinder was perforated on the inside to give the sound waves ready access to the absorbing insulation. We gave the two cross partitions the same





...Helps You Sell Your Maintenance Costs to Puzzled Management

When something goes wrong you can make a shrewd guess that makes sense to all concerned, using sketches, *facing page*, and then put your ideas to work. Pictured above are just two special problems handled this way. The unit at the left created a noise that sound insulation licked, while the one at the right sprayed water over the neighborhood that we beat with set of eliminators

treatment. By the way, we hold these partitions in place with a single brace set at right angles. As you can see, we had to put in doors so we could get at each fan for inspection and maintenance.

Then we gave the air inlets the same treatment. Sound-insulation went in around the air louvers. We found these moves brought our noise level down to where the complaints stopped.

What about tower performance? There is no doubt that the tower capacity suffered from these operations. That, too, we could predict, and with the aid of our simple sketch above, showed management how come. They could see that the sound-insulation was bound to pinch off free air flow into the tower and add an extra load to the fans on the discharge side. Just how much it suffered we don't honestly know. Apparently the tower was oversized because the air-conditioning system it serves has experienced no noticeable hardship.

Moisture Sprays. Sketch right, above, shows the second of our cooling-tower headaches. This unit was housed above the roof in an enclosure or tower of brick faced with white tile. It's a forced-draft design but it was laid out with enough foresight to assure that the discharge carries well up. There's been no problem of recirculation, as you might think. But again it was neighbor difficulty. They complained that the moisture, spray or mist obstructed their view and created a dismal, gloomy atmosphere in addition.

This particular problem is a pretty common one, we found, especially in built-up areas. And there are a number of things you can do.

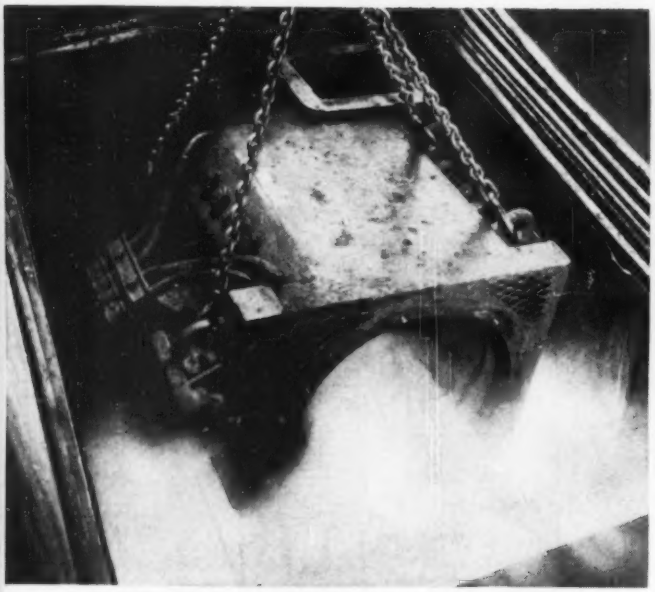
The answer to us seemed to be a second set of eliminator plates. We showed management that eliminator plates, set on top of our simple sketch, right, facing page, were supposed to prevent just this sort of trouble. The reason they didn't was that the original set of eliminator plates didn't offer enough of a barrier. The second set, sketch right, above, did the trick all right. But while it removed the moisture complaint, it cost us about 10% of the tower's capacity.

Aside from all this we ran into other problems. We had to waterproof the inside of the brick enclosure because the water penetrated the brick and, in the winter, froze. This developed serious cracks in the enclosure.

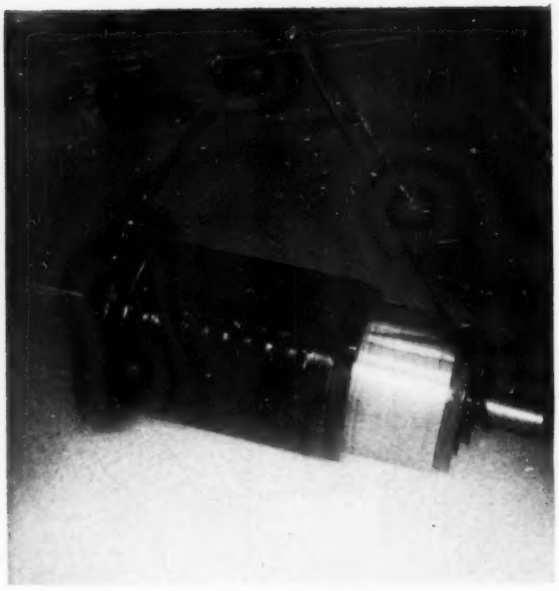
Next, we found the air inlets producing their own brand of trouble. Even though we faced them with copper the structural steel immediately behind suffered from rust attacks. This rust, plus the dust build-up on the long vertical members, caused rusty, dirty streaks to show up on the tile below the air inlets every time it rained. The way out was easy, but it escaped us for a long time. What we finally did was put in a gutter to collect all the points of drip and lead them away to where they were no problem.

Active chemical attack was our third and last problem. It was more advanced in one tower than in the others because it is steel and close to the power plant. On certain days, we know we pull in some of the stack discharge. Not much, but enough to affect the pH of the water, which has its own corrosion tendencies anyway.

The solution here is water treatment. The exact treatment we follow came as a direct result of our calling in a reputable water-treatment firm. By keeping close check with this company, and following their recommendations, we already see definite improvement. As you probably know there is no one way to handle all water-conditioning problems so there's no point in laying out our exact procedure. You'd have to work up your own in any case.



CLEAN **VAPOR-PHASE** degreasing is done with vaporized solvent in tank. Cold motor condenses vapor, which runs off carrying grease, dirt



ARMATURE in degreasing vapor. If part stays in tank until it reaches vapor temperature, uncondensed solvent will attack paint and varnish films. Remove part before condensing stops

Cleaning, Dipping and Baking Tips

- ***Many varnishing ills stem from grease, dirt and other contaminants on dipped part***
- ***Others come from specific gravity or viscosity changes due to heat and oxidation***
- ***Bad mixing and proportion between varnish and thinner can give lots of trouble, too***
- ***Here is a rundown of good cleaning methods and ways to keep your varnish in tiptop condition for best dipping, impregnating and baking jobs***

► FOR A GOOD VARNISH job, the piece must be *clean*. A lot depends on this step because a good many varnishing problems can be traced directly to grease, dirt and old insulation missed in the cleaning operation.

Several cleaning methods are commonly used: (1) hand washing with suitable solvent or detergent, using rags or brushes (2) pressure spraying with solvents or a steam jenny (3) vapor-phase degreasing (4) pressure blasting with mildly abrasive material (5) combination of two or more.

Hand washing is the most common method. It can be used on equipment of all sizes and calls for the least capital outlay. Solvents for hand cleaning include naphtha, Stoddard's solvent (a mixture of cleaning naphtha and carbon tetrachloride), trichloroethylene and perchloroethylene. Naphtha is highly flammable and fumes from other three are somewhat toxic, so cleaning with solvents should be done only when well away from flame, heat or sparks, and with good air circulation.

Du Pont has developed a cleaning mixture that minimizes the bad points of petroleum solvents. It is marketed under the name Cleaning Mixture #49.

Detergent solutions are sometimes used, but aren't as effective as solvents. Detergents, too, are not chemically neutral, and must be rinsed thoroughly from clean coils or insulation will slowly deteriorate.

Pressure-spray cleaning with solvents or steam is faster and more thorough than hand washing. Precautions with solvents, of course, must still be used. Steam and water vapor will not hurt insulation and varnish film but, since water and grease don't mix, steam is not as fast as solvent spraying.

Vapor-phase degreasing is a relatively new development. Chlorinated solvent, such as trichloroethylene or perchloroethylene, is heated in a closed tank until it vaporizes. When dirty part is lowered into hot vapor, solvent condenses on cold surfaces, runs off carrying dirt and grease. If, however, piece stays in tank until its temperature reaches that of vapor, uncondensed solvent will attack paint and varnish films.

Air blasting with mildly abrasive material, such as ground corncobs, is another recent cleaning method. Standard sandblasting equipment can be used for this job. For best results, piece

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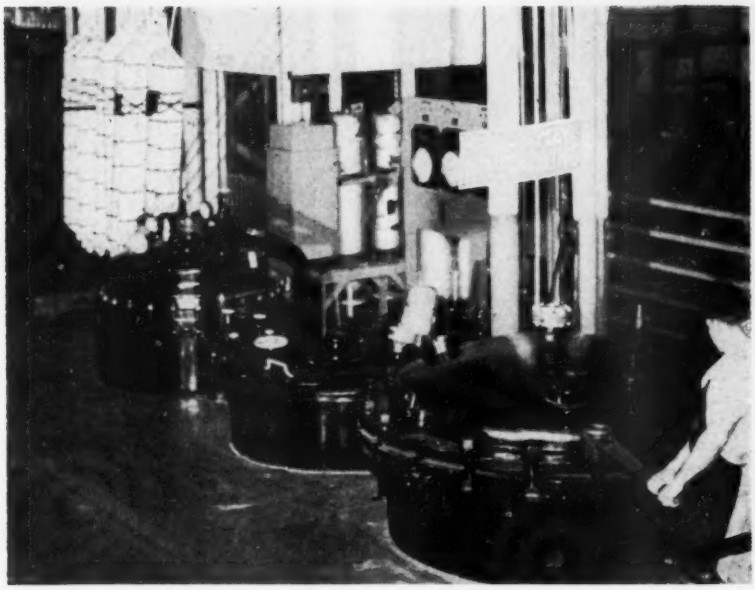
Basic information for this article was obtained from National Electric Coil Co, Columbus, Ohio.



DIP TANKS for dipping should stay at room temperature, be covered when not in use. Heat and exposure to air will change varnish specific gravity and viscosity. Preheated parts should cool below 140 F before dipping

MOTOR frame, field coils get varnish dip. After soaking, drain for at least one hour, then bake at 275 F, or above

For Your Electrical Varnish Jobs

should first be solvent cleaned, with blasting used to remove brittle varnish films without injury to winding or mica commutator insulation.

All these methods work if done properly. But most important is getting piece completely clean before varnishing. Each unit should also be baked out and tested after any cleaning, and before treating with varnish.

Modern insulating varnishes use a synthetic resin base (bakelite, polyester, glyptal, etc). These materials are *heat reactive*, that is, they set up and cure by heat. Some oils blended with the resins require oxidation to cure, hence the combination of heat and air in baking ovens.

But varnish in tanks is (1) warmed by preheated parts being dipped (2) oxidized and its solvent evaporated by surface exposure to air, and (3) contaminated by oil, dirt, carbon and grease left on objects immersed. So it's almost impossible to keep used varnish in top condition unless carefully handled under optimum conditions.

Pointers. Here are some hints to follow:

Keep varnish in dip or vacuum impregnating tanks close to room temperature, 70 to 90 F. If parts are preheated before treatment, let them cool to 140 F or below before dipping. Heating varnish will increase viscosity and evaporate thinner.

Keep tanks covered at all times when not in use to prevent oxidation of oils and evaporation of solvent. A blanket or slight pressure of an inert gas like carbon dioxide (CO_2) or nitrogen (N_2) in storage tanks is very helpful. Stir tanks often to cut separation of solvents from solids.

If it's necessary to treat a dirty piece, wrap it in muslin or duck cloth. When part is drained, sack will catch most contamination. In systems having recirculation or transfer pumps, filter is often put in line to strain out solid particles.

Varnish viscosity will go up even when specific gravity is held constant. This is especially true in large tanks that seldom have new varnish added. So it's wise to measure viscosity at least twice a week. Because viscosity varies with temperature, bring your sample to a constant standard temperature each time before measuring.

Holding down viscosity with a lot of thinner can be tricky. If proportion of thinner to nonvolatile content of varnish gets too high, varnish base will coagulate or separate out of your solution.

When mixing thinner with varnish, be sure both are about the same temperature. Adding warm thinner to cold varnish or cold thinner to warm varnish may cause varnish base to go out of solution. Add thinner slowly with constant stirring to make sure of thorough mix.

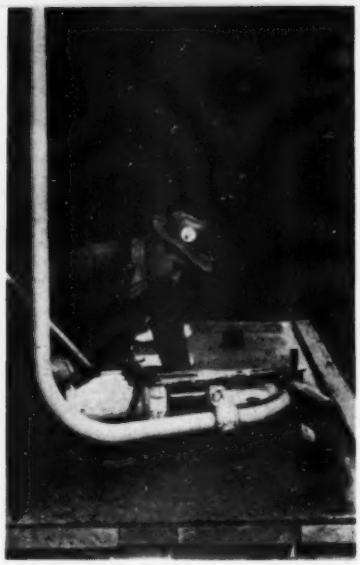
When you reach proper consistency, measure specific gravity with a hydrometer designed for liquids lighter than water. Then hold that specific gravity by adding thinner to within plus or minus .001. Specific gravity will also vary with temperature, so correct measurements to same standard temperature used for viscosity tests.

For best results in vacuum impregnation, preheat piece in baking oven, and let cool to 140 F or below. Place in tank and draw best vacuum possible. Stop vacuum pump. Then, without breaking vacuum, admit varnish until its level is at least 12 in. above windings. Release vacuum and let part soak. If you like, apply 75-80 psi inert atmosphere (CO_2 or N_2) above varnish.

Transfer varnish back to storage tank and let piece drain for at least one hour. Then bake with good air circulation at not less than 275 F.

Pointers On Bending Thin-Wall Conduit

ROLL-TYPE bender works well on small sizes; use it at bench or floor level



HYDRAULIC bender will take care of the larger size and heavier wall conduit

When your men install thin-wall conduit, they'll have to use these basic bends. Here's an accurate and practical way to bend the small sizes by hand

► MAKING ACCURATE BENDS on thin-wall conduit, or electrical metallic tubing, is of course largely a matter of skill and practice. The method shown here is useful for bending the ½, ¾, and 1 in. sizes by hand.

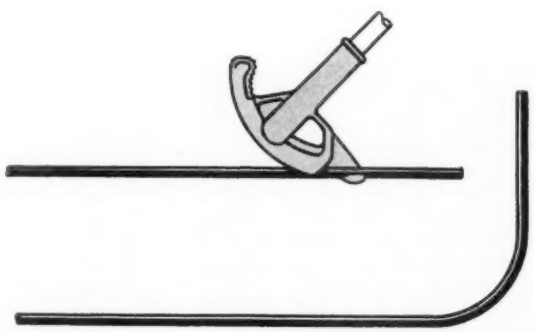
To be sure of smooth, correct bends in tubing larger than 1 in., use factory-made elbows, or make the bends with a heavier bender, one type shown above, right.

Roll-type bender illustrated has high supporting sidewalls to prevent flattening or kinking the tubing, and a long arc that permits making 90-degree bends in a single sweep.

Accurate Stubs

Roll-type bender makes it easy to figure stubs accurately. For any given-size tubing, there is a definite take-up or rise. To figure take-up, mark the tube, place end of bender at the line, and make a 90-degree bend. Distance that you raise mark is the basic stub measurement. Stub of any height can be made by making up difference in the straight leg.

Radius of 90-degree bend must be minimum of six times inside diameter of conduit, according to National Electrical Code. Electrical metallic tube (EMT) benders are designed to meet this requirement.

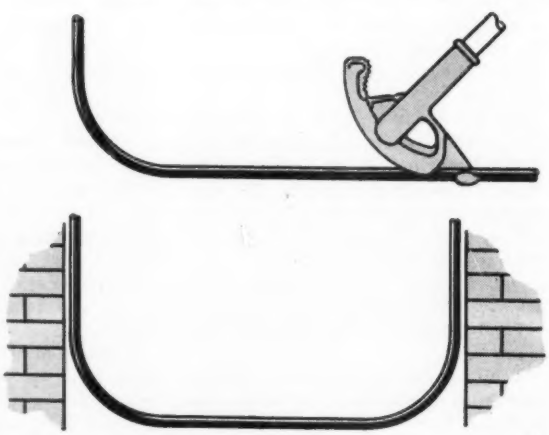


Back-to-Back Bends

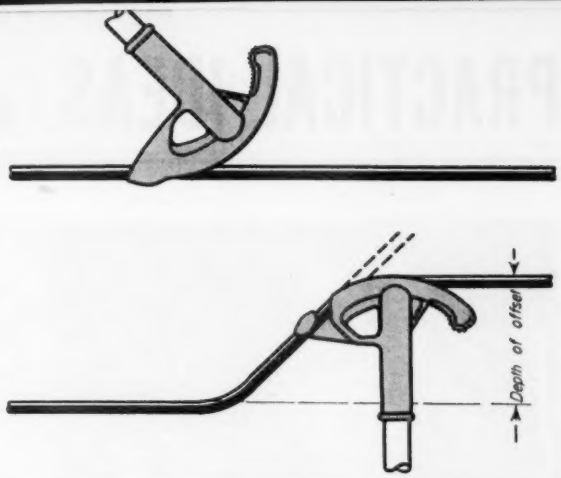
Count on horizontal take-up when planning back-to-back bends. To find this, place tubing on floor, mark both tubing and floor, then make 90-degree bend. Horizontal take-up is distance between floor mark and vertical section of tubing.

For back-to-back bends, first make one stub, as above. Then measure length of run desired, figured to outside of tubing on finished bend. Add horizontal take-up. Measure off this distance on the EMT, insert bender, and make bend.

When working at floor level, keep foot pressure on bender step to hold tube in supporting sidewalls. At bench height, exert pressure close to the bender. This prevents kinking, holds tube to exact radius.



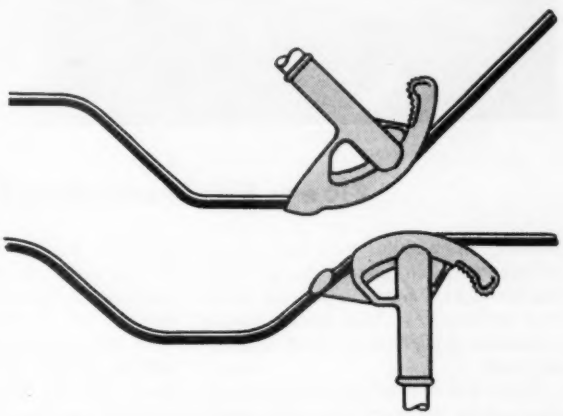
To Make an Offset



Make the first bend of an offset far enough from the obstruction to allow clearance at desired angle. Second bend, at point directly over the obstruction, should be equal in angle and opposite in direction to the first one.

To make 45-degree bend with tool on floor, insert tubing, pull until bender handle points straight up. Location for second bend may be determined this way: Hold bender vertically. Slip tubing through the holding hook, so lower part of the first 45-degree bend will be the desired offset depth below top of bender. (Measure depth vertically along handle.) Make second 45-degree bend at this point. Be careful to keep the offset flat.

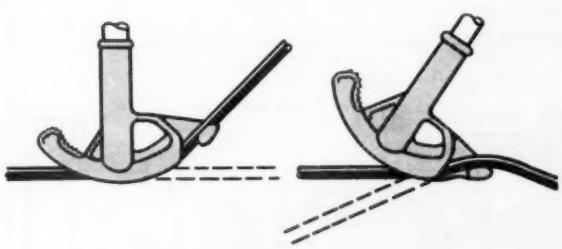
To Saddle a Beam



First make an offset as described above. Then lay tubing across the beam and mark where edge of beam will fall. Place tube in bender with hook toward finished portion of offset. Make a bend equal in angle to the first two bends. Reverse bender and complete the saddle by making a fourth bend of the same angle, in the same horizontal plane as the first bend. Both legs should be even and all bends should fall in the same vertical plane.

With parallel runs of several conduit sizes, job-made bends, all made from the same center, look the neatest. Use bend of largest conduit in the run as a pattern.

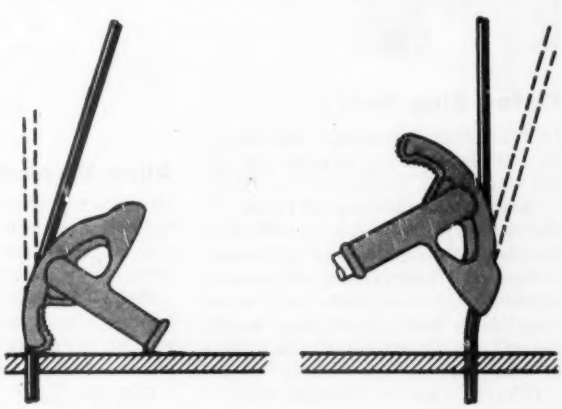
To Make a Saddle Bend



Saddling a small obstruction—for example, another length of conduit—is accomplished with three bends. Make the first, approximately 45 degrees, directly over the obstruction. Then determine length of the straight legs required to provide necessary saddle rise. Complete the saddle by making a 22½-degree bend at the measured point on each straight leg. The 22½-degree bends are made in the direction opposite to the original 45-degree bend.

On saddles smaller than 1 in., make the first bend slightly greater than 45 degrees. Otherwise make a 45-degree bend.

Shifting Stubs

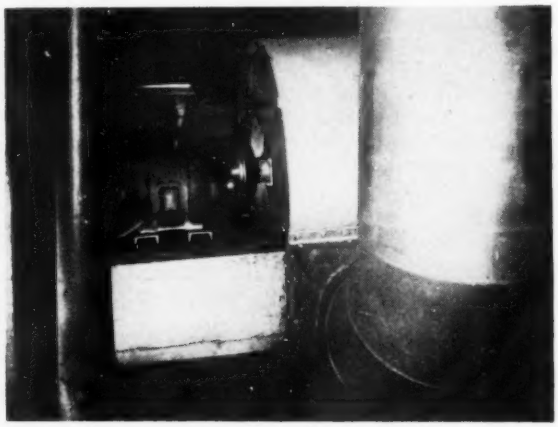


To alter position of a vertical run when stub is slightly out of line, remove handle from bender and rest it on the floor. Brace bender with foot and apply pressure against tubing to make first bend. Replace handle and slip bender over tube at point where vertical run should be. Draw stub to correct vertical position. Result will be compensating offset.

If necessary to make offset closer to floor, chip away concrete, drop bender below floor line for first bend.

For material in this article, POWER *wishes to thank Republic Steel Corp, Steel and Tubes Division, and the American Iron and Steel Institute.*

PRACTICAL IDEAS...*here's the trading post for your*



Blower Ups Production, Saves Over $10,000 a Year

BEFORE INSTALLING a forced-draft blower system on four 125-hp, hrt boilers, seven men were needed for a 24-hour working day. That was to operate a sawmill of 80,000-board-feet capacity per shift.

Three men worked each shift to stack wood slabs and hand-feed the wood furnaces. Seventh man banked and fed the fires during the graveyard shift.

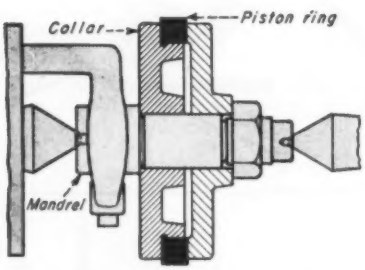
In winter, under certain weather conditions, because mill is in a narrow valley, there wasn't enough draft to burn the wet redwood. Redwood has a tendency to smother fires, causing lost production.

To help overcome this condition, we selected a tank for 300 lb of domestic heavy fuel and piped it to each boiler. Then we installed lines to carry steam to heat and blow fuel into furnace boxes. This system increased cost from $800-1000 a mo, but did little good.

Then I got the idea of putting in a forced-draft system. I used a 7½-hp electric motor from spares supply, piping and blower from an idle planer. We bought dampers and elbows for the large 24-in. air-supply line. Cost was about $200. I installed everything in about 60 days, during my spare time as operating engineer.

Since July 1951, we have saved over $25,000 in labor alone. Production has increased as the men are on other jobs.

R ULMER *Klamath, Calif.*

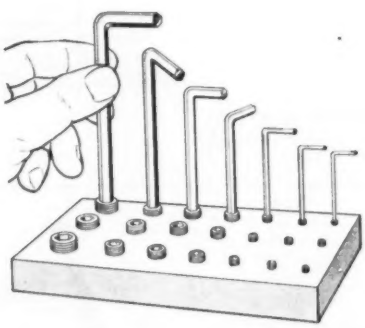


Piston Ring Holder

IN JULY 1952, *Piston Ring Manual*, device can be improved to hold split piston rings while turning to true circle.

Sketch shows clamping rig I made for this purpose. Split ring is collapsed into clamp while nut is only tight enough to keep ring from opening. Then nut is tightened. Since we make only a few rings down here (away from supply houses) during overhauls, clamp need hold only one at a time.

D NEUBAUER *Santiago, Chile*

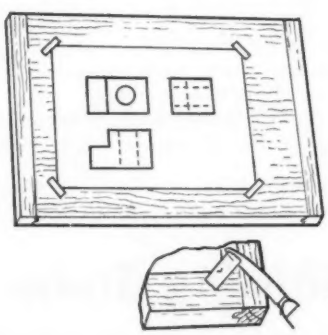


Allen Wrench-Set

HERE'S A HANDY service-bench block for headless Allen setscrews. Made of cast iron, it holds setscrew wrenches and some extra screws, sketch.

Holes in block are tapped to sizes most used in our work. With this holder, you can always find a wrench or a replacement screw in a hurry.

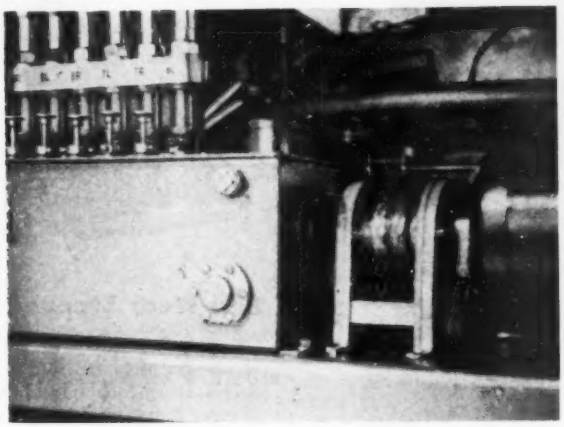
C H WILLEY *Penacook, N. H.*



Scotch-Tape Your Drawing

ATTACH DRAWING PAPER to drawing board with scotch tape, as shown. I find paper is held more securely. T-square and triangles can be moved over drawing more easily. Also, paper is not marked with holes and board's surface remains perfectly smooth, no matter where paper is placed on it.

T TRAIL *Catonsville, Md.*



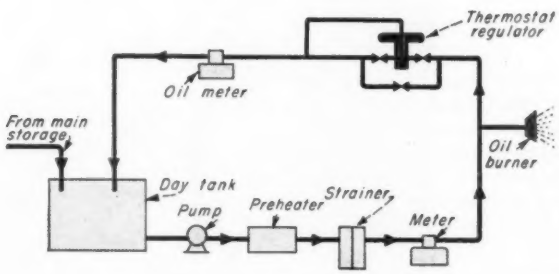
Safe-Coupling Guard for Lubricator

PHOTO SHOWS GUARD I made for the force-feed lubricators on our radial-diesel engines. They are made so the coupling is completely visible. This enables operator to check its operation and condition.

Guards are needed because one time a rag had wrapped around coupling. That was a hazard. We don't worry about that happening again as all couplings in this plant are protected.

Outer edge of guard is scrap-aluminum molding, folded so wire mesh used in plaster can be inserted, clamped together. Construction is sturdy.

M J HERZING *Milaca, Minn.*



Regulator Assures Plenty of Hot Oil

WHEN OUR PLANT started up we had trouble with our bunker-C fuel oil getting cold at times. We burn oil only as a secondary fuel. Solution was a thermostat regulator in the return line to service tank.

When temperature of oil drops to a fixed temperature setting on the regulator, regulator opens and circulates oil till a fixed temperature is reached. Then regulator closes off. The cycle keeps repeating itself. Now we have hot oil at all times, at right temperature.

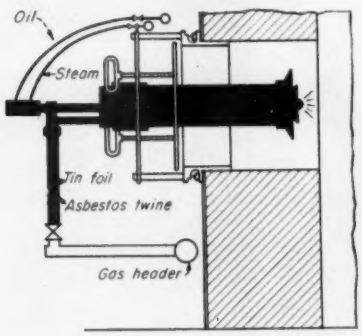
NOTE: Oil meter on return line can keep up with oil burner this way and with oil circulated.

B D RILEY *Brunswick, Ga.*

Good Advice

STOW your boiler-casing sealing compound, electrician's "gunk" (duct seal), friction tape and similar materials in a warm place. They'll always be soft and pliable, ready for instant use.

E R ECKERT *New York, N. Y.*



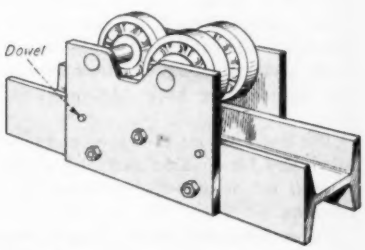
Protect Burner Hose

ANY ENGINEER, who has had rubber hose age prematurely or from radiant heat, can profit from a simple idea we tried.

Two boilers with both oil and gas burners, sketch, operated several months on gas fuel. One week after starting to burn oil, rubber gas-burner hose was badly cracked and charred on side next to furnace.

New hose were installed, but in several days there was noticeable burning. The hotter and more luminous oil flame impinged a beam of radiant heat on hose, enough to burn it. We wrapped hose with tin foil, held in place by a spiral of asbestos twine. This reflected heat so well that tin foil actually felt cool to the hand. After using it for more than a year we've had no further trouble from burning and charring.

J R MISENHEIMER *Tulsa, Okla.*



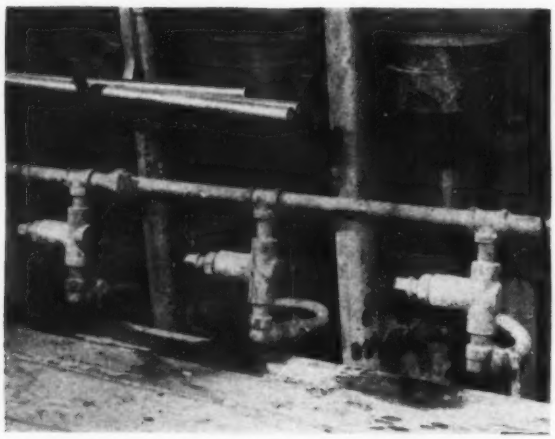
Old Ball Bearings Make Balance Set

WE SCRAPPED EQUIPMENT having good ball bearings, but saved these bearings and made them into a balance set for rotors. Our plant welder made sets, sketch. Medium- and small-size set shown have proved very useful for balancing all our auxiliary equipment.

J A SWANSON *Princeton, B.C.*

(*Continued on page* 132)

Begins on page 130



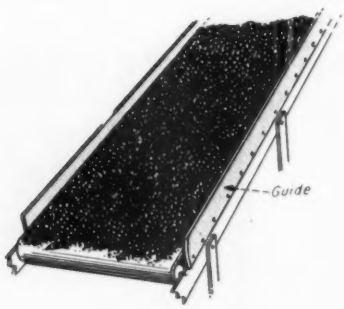
Wire-Braided Hose Stops Vibration

WE MANUFACTURE rubber conveyor belts at the Thermoid Co, and curing these belts takes place in long presses. Hydraulic pressure is applied to belts by 12 pistons. Pistons are worked by water under 2200 psi from a long, metal standpipe. Before, each piston was connected to standpipe by rigid metal pipes of 90-deg bend. Vibration caused connecting pipes to break.

We licked this problem by using our own product. Answer was high-pressure, powerflex, hydraulic, wire-braid hose. Pipes were replaced by 12 short lengths (about 15 inches long) of hydraulic hose taking a 90-deg bend. Hose is built to stand these pressures, yet is flexible enough to absorb vibration caused by hydraulic-pump pulsations as pistons raise the bottom half of press against top.

After four years, hose connections are still going strong. No more lost production and no maintenance since hose was installed.

BUCKO JONES *Trenton, N. J.*



Belt Wear Stopped

UNDUE BELT WEAR on portable belt conveyors can often be stopped by adding guides along each side of belt. Unless proper alignment is closely watched, belts have a tendency to creep over to one side, rubbing against troughing roller brackets. That wears out belt in short time.

Conveyor belts are very expensive, so any improvement to increase life is a big help toward reducing maintenance cost.

To overcome this undue belt wear, we installed guide strips along each side of belt. Guides run full length of the belt.

They overlap about one inch with just enough clearance so that belt slides through. Since guides were installed, belt life has doubled.

H T BAILEY *Brillion, Wis.*

Ice Does Damage

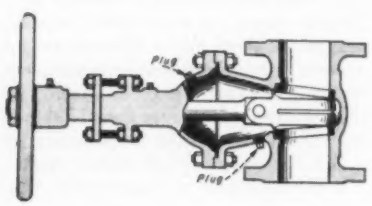
WE LEARNED it's expensive to replace a split 14-in. OS&Y (outside screw and yoke) gate valve. Valve was on exposed line used to load a sludge vessel. With winter coming, we took precaution by pumping back (draining) the line.

The day after an 11-degree night, we filled line for loading and had sludge all over our sewage-disposal plant next morning.

Valve froze and split. Reason was that when a gate valve is closed while under pressure, yoke stays full, sketch, of whatever line carries (except steam).

In our case, where line can be relieved of pressure, proper freeze-up safeguard is to leave valve at least half open. In this way yoke empties out. On other exposed valves that cannot be left open (line under pressure) drill and tap for two ½-in.-pipe plugs. After valve is closed, remove both the "vent" and drain plugs.

F J ARDALINO *Brooklyn, N. Y.*

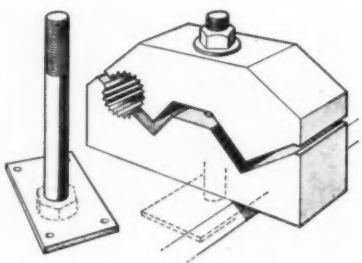


Keeping Valve Stem Clean

WE HAVE a tough problem with flyash and coal dust, as do most pulverized-coal-burning plants. We find that a piece of rubber hose, same length as stem of a rising steam valve, makes a good protector. It also keeps the threads clean.

Rubber is also a safety device if valves are likely to be bumped. For valves in vertical position, cut hose an inch or so longer than stem. Plug end of hose with a wooden plug or whatever is available or handy.

JERRY TRNCAK *East Alton, Ill.*



Special Clamp Vise

SKETCH SHOWS unusual holding device built to do a special job. It has proved very useful and handy at the bench or on platen of a drill press.

Clamp is machined of good steel and jaws hardened and tempered. Plate with clamp-bolt welded to it allows either jaw (round or angle) to swivel as needed. Size of this device depends on your own need. We made ours to handle 2-in. angle iron, and ½- to 1½-in. round stock.

C H WILLEY *Penacook, N. H.*

(*Continued on page* 134)

Leading utilities specify

USKORONA

because it's the tape that will not break down

USKORONA SPLICING COMPOUND
US
¾ IN. WIDE
30 FT. ROLL
OZONE AND MOISTURE RESISTING COMPOUND
Uskorona combines maximum resistance to OZONE and MOISTURE with high tensile strength, elongation and dielectric resistance. Fuses quickly without heat or pressure and makes PERFECT SPLICES.
MADE IN U.S.A.
United States Rubber Company

LET US SEND YOU A SAMPLE

U.S. RUBBER
SERVING THROUGH SCIENCE

U.S. Uskorona was the only tape of 4 leading brands that was still intact after a 4-hour corona-(ozone) resistance test. All others broke down.

Even after 500 additional hours of consecutive exposure, Uskorona remained as fresh and corona-resistant as at the start.

More amazing still, Uskorona is the only tape that is resistant to both corona and moisture.

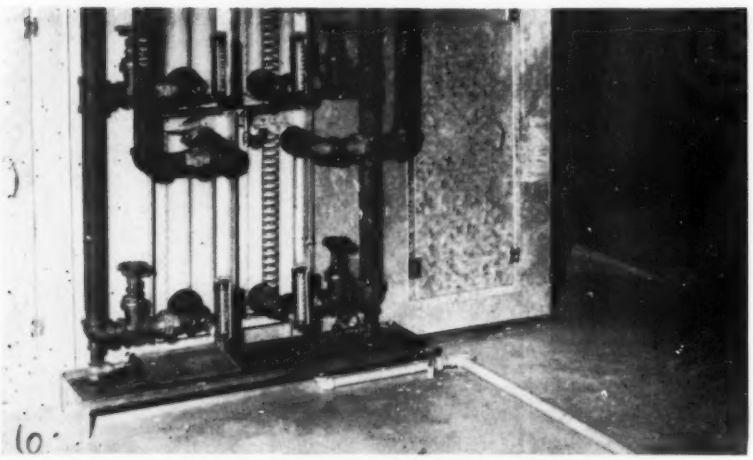
No wonder many a leading power company has made Uskorona standard for underground splices, joints and connections. It is thoroughly effective on single or multiple cable, on secondary network systems, street lighting circuits and transformer leads.

For more data on moisture- and corona-resistant Uskorona, write to address below.

UNITED STATES RUBBER COMPANY

TAPE DEPARTMENT • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

Begins on page 130



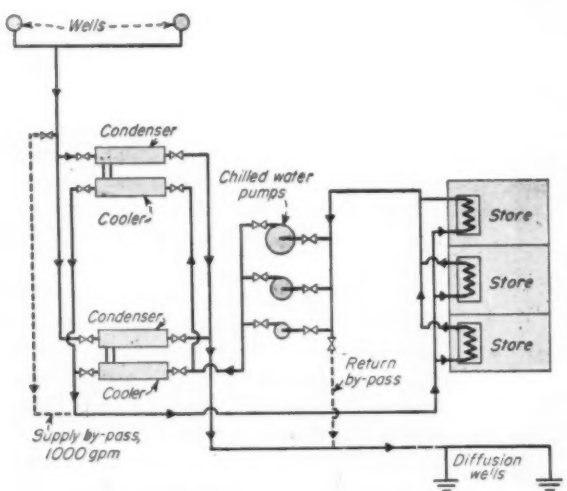
Drip Pan Keeps Floor Clean

CHILLED-WATER LINES for air-conditioning systems often sweat, even after they are insulated. Sweat on insulated lines is usually around valves or at ends of insulation.

To keep floors dry, I always place a sturdy drip pan with legs under lines, hooked to a half-inch drain. Drain line has tee instead of ell near pan, so it can be cleared if plugged. That happens whenever careless employes throw either match sticks or cigarette butts into the pan.

These little refinements on machinery I install please customers because system not only works well but is easy to keep clean.

MIKE BRANNIGAN *Kansas City, Mo.*



How to Find Leak with Test Tube

OUR HOUSING DEVELOPMENT has 140 apartment buildings and 40 stores. There are banks, theaters, bowling alleys, 4 huge garages, etc.

Steam for heating and hot water is from four high-pressure boilers, through high-pressure underground mains to six outlying reducing stations, reduced to 10 psi. Ten psi mains distribute steam to substations or control rooms, where it's reduced to vacuum steam for heating. Vacuum steam is also for hot-water heaters, two to each control room. Control room also has a heat exchanger, through which cold water passes before entering water heater. Condensate returns from heating mains pass through heat exchanger, giving off excess heat to cold water.

Careful records are kept, including graph of all pertinent data, such as steam generated, fuel consumed, kw, and percent makeup.

Recently the Chief started program of repacking the many pumps. He was pleased to see makeup gradually drop within a week. Then it dropped to zero and condensate tank began to gain water. We ran water to sewer.

We had a leak *into* the system. Since quality of return condensate was good, it was a fresh-water leak. We concluded it was in one of 75-odd hot-water tanks or heat exchangers.

First method was to check each tank by shutting off steam valve and breaking condensate connection at trap. Then water flow would indicate a leak. In one day two men checked eight tanks. Looked like two weeks to finish job.

At the time, city water was running about 28 ppm hardness. So we decided to test for leak using new hardness titration method.

First we tested three condensate mains entering plant. No. 1 and 2 showed zero hardness, but No. 3 had 6 ppm hardness. Leak had to be in that line. No. 3 splits into two parts, serves two hp stations. So we tested water in main receiver of station No. 3 and No. 4. No. 1 showed zero, but No. 4 showed 12 ppm. Now we were getting warmer. Since this station served substations A, B, C, D and E, we had to test them all. C showed 24 ppm, so leak was in one of eight stores. Of these stores, two were suspected—drugstore soda fountain and super market. Test of each showed it might be drug store. We quickly tracked that down to a broken coil in a hot-water "booster" heater, providing water of 180 F for the dish-washing machine.

Time required to find leak from beginning of investigation was six hours. We didn't even know we had this heater as it was installed by store owner's plumber. This test saved several hundred dollars in labor costs, wasted water and chemical treatment for boilers.

Method can be modified to test for contaminants like acids, alkalines, chlorides, and might be useful in process work.

W J STEINERT

Fresh Meadows, N. Y.

NO SEAT TO SCORE, WEAR,
CLOG OR LEAK • O SEAT TO
OR LEAK •
TO SCORE, WEAR,
EAK • NO SEAT TO
R, CLOG OR LEAK •
SCORE, WEAR,
• NO SEAT TO
AR, CLOG OR LEAK •

● *Yarway Seatless Blow-Off Valve showing balanced sliding plunger in closed position. For pressures to 400 psi. Available singly or in tandem, angle or straightway.*

BEHIND IT . . . *AN ENGINEERING REASON*

More than 16,000 boiler plants use Yarway Blow-Off Valves. Why?

Because behind each valve is an engineering reason.

Take the Yarway Seatless Blow-Off Valve for low and medium pressure boilers. *It has no seat to score, wear, clog or leak.* The unique balanced sliding plunger eliminates a common source of blow-down valve trouble. Many boiler shut-downs are saved . . . power interruptions avoided and . . . production speeded.

Specify Yarway Blow-Off Valves on your boilers—*including package units*. You'll be rewarded by dependable, trouble-free blow-down service.

Write for Yarway Blow-Off Valve Bulletin B-425 (pressures to 400 psi) or Bulletin B-433 (pressures to 2500 psi).

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YARWAY | *blow-off valves*

PLANT PROBLEMS... *put your know-how to work*

How Many Men for Electrical Maintenance?

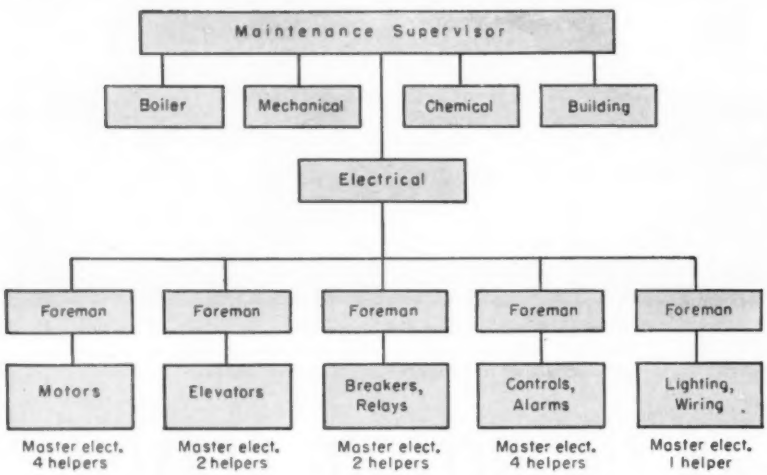
HERE ARE THE FACTS: Within about a month our new industrial plant for manufacturing chemicals will be ready to begin production. It has close to 4000 motors ranging from fractional to 600 hp.

Right now I'm planning my electrical maintenance crew. We plan to do all ordinary maintenance jobs, but will send heavy coil-rewinding jobs to a local shop.

Besides these motors we'll have modern lighting throughout the plant, several elevators, complete alarm systems for process vessels, and numerous automatic controls.

How many foremen does our electrical department need? How many master electricians and helpers? What's best way of deciding number of men for each job?—*KL, Feb Power*

Here Are the Answers



ORGANIZE various plant-maintenance sections under a maintenance supervisor, as in diagram. Electrical section is shown in detail, indicating the different groups. Each has a maintenance supervisor and a master electrician.

Since this is a process plant the term "elevators" may also include materials-handling equipment. If only elevators are used in the plant, the motor, control and alarm groups can handle their maintenance. Also, only one helper would be needed in the breaker and relay group instead of two.

Many plants don't have a separate group for lighting and wiring. Free helpers or electricians from another group can often change bulbs, fluorescent fixtures, or install new circuits.

Since most process plants have many alarms and controls, a separate group for their care is needed. Experience shows *KL* will have to make a thorough study of his plant before deciding exactly how many men he needs. Remember, a good ratio for number of men to each foreman is 4:1.

A J Breugelmans *New York*

START WITH one general foreman for your electrical department. Have one master electrician to supervise installation, repair and trouble-shooting of motors. *KL* will also need a man for actual motor work like repairs, rewinding, turning of armatures, and other jobs.

Use one master electrician to supervise wiring, lighting, elevators, alarms and controls. Provide helpers for each master electrician.

Set up shifts according to plant operating periods, using one general electrician and helper for each shift. Add more men later, if needed.

S F Wilson *Princeton, N. J.*

DIVIDE PLANT into sections, with a working foreman in charge of each section. He is responsible for proper operation and maintenance of all electrical equipment in his section.

Provide section foremen with a skilled crew of sufficient size to permit good care of equipment. Keep diagrams of each unit close to it or mount diagram on unit if there is enough space. Assign a tool crib to each section, and keep small replacement parts in it. Do major jobs in the repair shop.

See that each section has a regular program of preventive maintenance, which includes periodic inspection of all equipment for overheating, bearing failures, lubricant condition, and other troubles that occur. Repack leaky valves and replace lighting units in groups. Have main shop do general repairs like welding, carpentry, plumbing and similar jobs.

Be particularly careful about controls and alarms in process plants. Check them regularly by suitable tests.

L E Polikoff *Brooklyn, N. Y.*

TWO CLASSES of men are needed for maintenance in this plant. First includes mechanics from the major trades. If production shifts rotate their working hours, the mechanics rotate with the shifts .

Second class includes mechanics from all trades needed. They work on day shift only except in emergencies when they work as needed. Store small replacement parts within easy reach of mechanics in the electrical shop. Then men on all shifts can make minor repairs quickly without wasting time getting to and from the main stock room.

Keep shift electricians busy by having them do repair or maintenance work on smaller motors and devices. They can also perform many routine maintenance jobs in a large plant. But keep in mind that the first duty of a shift electrician is to clear breakdowns as soon as possible after they occur. This saves many hous of lost production.

Frank Gillmor *Albany, N. Y.*

BEST WAY to find number of men needed for electrical maintenance is by trial since each plant has different prob-

help the other guy cure his headaches

TYLER HICKS, *Associate Editor*

lems. But since I've been in charge of a plant of nearly the same size I can give *KL* a good approximation of what to expect.

Divide the maintenance gang into two groups, one for plant work, the other for shop work. Those on plant work do actual maintenance, but send to the shop motors to be rewound, starters to be repaired, meters to be recalibrated, and similar work.

Two foremen are enough. General foreman is responsible for all work, while shop foreman handles only men in the repair shop. Do all routine maintenance during the day, but have a small shift crew to handle trouble arising at night. Have one or two motor winders, four to six electricians, and four to eight helpers in shop. Any of these men can work in plant during emergencies.

Top diagram has typical setup that is usable. Some engineers prefer to have a general foreman with two foremen under him, one for the plant, the other for the shop. Sometimes this creates a feeling of "passing the responsibility" to the other foreman.

SERGIO MARTINEZ *New York, N. Y.*

TWO MASTER ELECTRICIANS, one in charge of plant work and the other for repair-shop duties, are needed. Center diagram shows how to set up their jobs.

A A HUNNEWINKEL *Woodstock, Ill*

ELASTIC SETUP is best until *KL* knows exactly how much maintenance is needed. Bottom diagram shows one way to assign the crew. Have each man turn in his job records to his foreman on printed forms prepared for type of work he does.

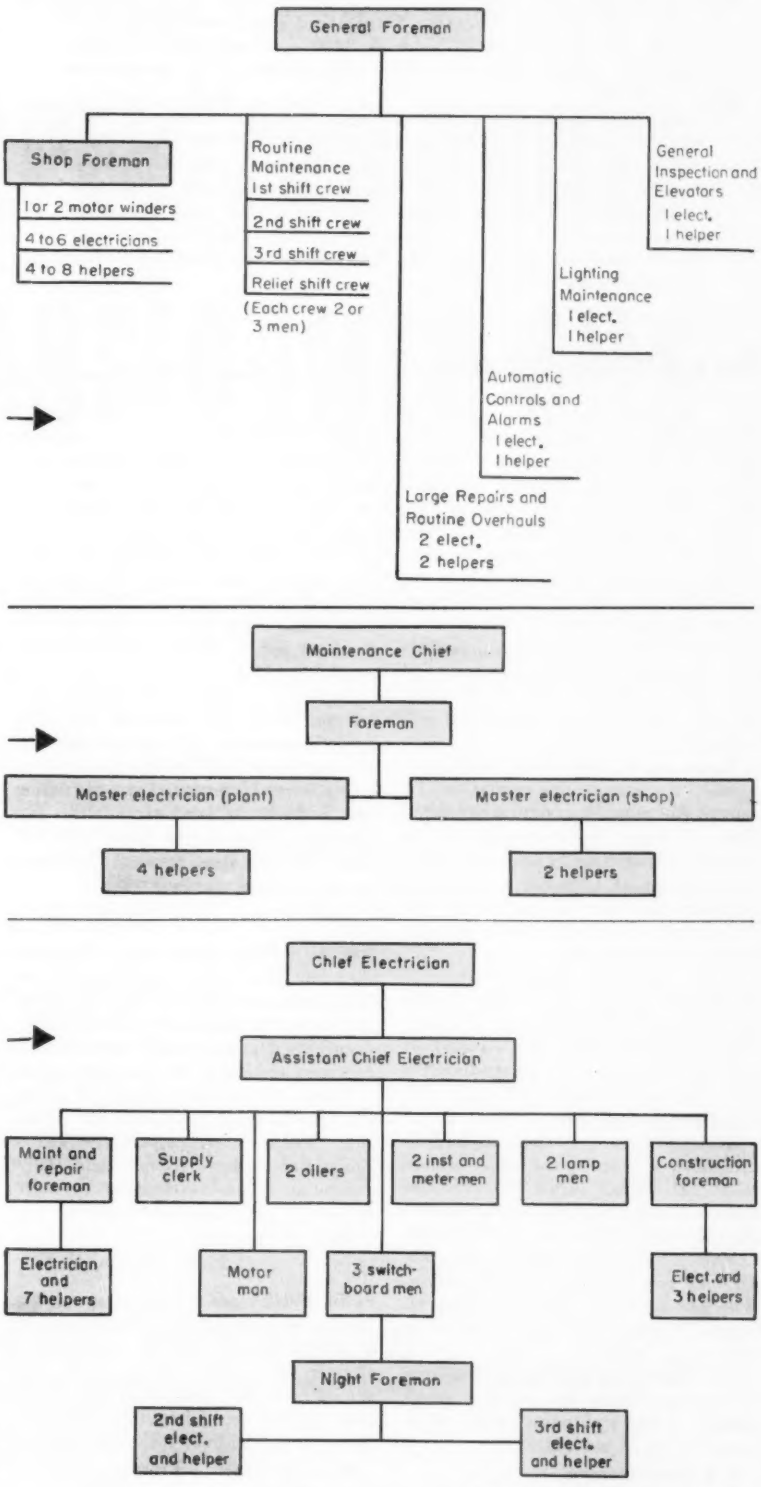
Amount of maintenance needed in later years often depends on how well the plant is designed and run. So pick your motors carefully and run them right after they're correctly installed.

C G HOWARTER *Canton, Ill.*

NEW EQUIPMENT, especially motors having ball bearings, requires less maintenance than older equipment. But play safe. Work out a maintenance schedule before plant goes into production so you can take care of any emergencies. Schedule and crew can be changed later, if necessary.

Try to recruit one or two good men from the electrical construction crew for your maintenance staff. You'll find

(*Continued on page* 204)



(More Plant Problems on next page)

More PLANT PROBLEMS

Begins on page 136

What Causes Feed-Pump Vibration?

HERE ARE THE FACTS: Our 4-stage feed pumps are designed to handle 650 gpm of 300-F water at 2400 rpm with 209-ft suction head and 1193-ft discharge head. Head developed by pumps was to be 984 ft.

First pump vibrates seriously at speeds between 2150 and 2200 rpm. Second unit developed same condition after running a short time. Third pump does the same after operating well three years.

Balancing drum and shaft sleeves on No. 3 were badly worn when we opened it. Replacing sleeves and drum hasn't done any good because pump still vibrates. Operating conditions are: suction head 225 ft, discharge head 1035 ft. What causes this vibration? How can we stop it?—*BP, Feb Power*

Here Are the Answers

CAVITATION on suction side of first stage of pump causes this vibration. This occurs when pressure in pump falls below vapor pressure of the liquid. Most probable cause of cavitation is decrease in total static head from design conditions. Bubbles formed in first stage are carried into the impeller where they collapse.

Other effects of cavitation include noisy operation, decrease in pump head and capacity and a fall in efficiency. Impeller vanes become pitted and corroded.

Throttling the discharge valve may reduce or eliminate this cavitation. Of course, you must be careful when throttling discharge valve because it increases the discharge head on the pump. Another way of reducing cavitation is to use an impeller with a larger eye. This reduces the conversion of pressure head to velocity head.

Other causes of vibration are: (1) insufficient support for suction piping or inadequate flexibility of discharge lines (2) rotor bowed or distorted by high temperature (3) casing distorted from uneven tightening of studs (4) unbalance of impeller.

Remember, pump casings are built to withstand a pipe thrust of a certain value. If actual thrust exceeds this value, the casing may distort. Determine allowable thrust from the manufacturer. Calculate the actual thrust, and compare the two. If actual exceeds allowable, add supports while the pump vibrates. If thrust is cause, the vibration will stop.

Use longer warmup periods to prevent bowed rotors. Or pump a small amount of water through casing while pump is out of service.

A J Breugelmans
New York, N. Y.

REFER TO CURVES of head and capacity to estimate flow at lower total dynamic head now existing. Then by referring to the centrifugal-pump section of *Standards of the Hydraulic Institute, BP* can compute the required net positive suction head (npsh) for his new conditions. For water at 300 F, *Standards* show total suction head needed is about 165 ft, which is less than the available 225 ft.

Difference between the 225-ft total suction head and required minimum npsh is available for overcoming pipe friction losses and for velocity head at pump inlet. If computed sum of friction loss and velocity head exceeds this difference, *BP* does not have sufficient npsh and cavitation results. This leads to erosion and vibration.

H B Wayne *Brooklyn, N. Y.*

INITIAL INSTALLATION and alignment may have been poor. See that recirculating valve and line are open and function correctly. Excessive vibration may occur when pump builds up too much pressure and water has no place to go.

Check for foreign matter in pump that causes shaft unbalance and vibration. Keep water temperature within limits manufacturer recommends. Don't run pump at too low capacity, pressure or speed. This can cause trouble.

Edward Delnick
Valley Stream, N. Y.

PUMP RUNS close to critical speed, according to facts *BP* gives. Design speed of these pumps appears to be only slightly above shaft critical speed. *BP* should increase pump speed but should first reduce pump-impeller diameter. Don't do this without consulting maker.

M L Freeman *Flushing, N. Y.*

(*Continued on page* 206)

YOUR NEW PROBLEMS

1 How Can We Detect Hot Bearings?

I run an industrial power plant and am in charge of all equipment for both power generation and process work.

Recently we've run into some serious trouble with bearings on heavy rolls overheating and burning out. This always occurs before we discover what is happening.

I'm convinced this wouldn't happen if we knew the bearing temperature, or had an alarm that indicated temperature was rising. If we know how a bearing behaves, we get to it soon enough to prevent burning out.

Have *Power* readers ever built simple devices that work well for this job? How are they best built? What materials and parts are needed?—*WC*

2 Is Rain Water OK For Boiler Feed?

We propose to collect rain water from our buildings' roofs, and feed it to our boilers. But before going ahead with the work, I'd like to get the opinion of *Power* readers.

Our boilers are watertube units. Three are bent-tube designs, three straight-tube types. Roofs of all buildings are slate and metal.

Rain water from the roofs is conducted through metal downspouts, and then through sewer pipe into underground concrete reservoirs. From this storage area we intend to draw water for our boilers.

All metal roof fittings and downspouts are copper. Will this affect rain water? What's best way of treating and pumping this water to boilers?—*WK*

Don't miss next month's problems. Another chance to use your ingenuity

Will you help readers who sent us problems? Extra pay for photos or sketches.

LEADING MANUFACTURERS HAVE HELPED "JOB PROVE" SUN TRANSFORMER OILS

Over the years, leading manufacturers of transformers have helped us "Job Prove" Sun Transformer Oils. They have found, through continuous use, that these Sun oils have the excellent heat-transfer characteristics needed to meet the requirements of today's transformers. In addition, they are highly stable and resistant to oxidation, completely dependable in protecting equipment and reducing maintenance and replacement.

Sun has had broad experience in the electrical industry. We have for many years specialized in formulating and supplying oils for cables, transformers and capacitors. Our knowledge of the industry's requirements, coupled with extensive research, development and refining facilities, enables us to offer products to satisfy the most rigid electrical requirements.

Let us tell you more about Sun Transformer Oils. Fill in the attached coupon. We'll be glad to help you solve your specific problem and recommend the proper Sun oil for your needs.

SUN OIL COMPANY, Dept. P-5
Philadelphia 3, Pa.

I would like to have more information about Sun Transformer Oils.

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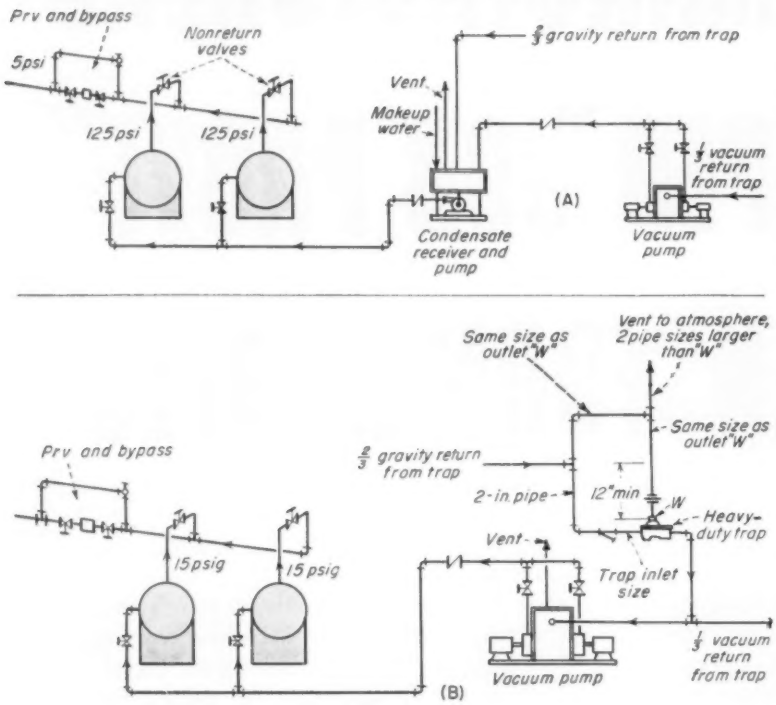
SUNOCO

More PLANT PROBLEMS

Begins on page 136

Another Answer to Jan Question, "How Can We Convert Our Heating Plant ?"



ASSUMING several conditions, I can give reasonable answers to *LW*'s questions. But before making changes, he may avoid expensive headaches by consulting his local boiler inspector. He may be a city, state or insurance-company man.

LW does not say why his boilers must run at 15 psi. If he is converting for operating convenience or economy and his controls are suitable for the lower pressure, original safety-valve capacity is sufficient. If pressure rises above the control setting, safeties will relieve at their present setting without harm.

If pressure is reduced because of boiler's condition, he must change safety-valve capacity and pop pressure. Remember, steam at 125 psig has a specific volume of 3.2 cu ft per lb; at 15 psig its volume is 13.8 cu ft per lb. This is an increase of about 4.3 times. Besides the increased volume, pressure available to force steam through the valve is less. With a smaller pressure differential, valve capacity is less.

Steam flow through a safety valve approximates flow through an orifice. By applying rules for orifice flow the lower pressure differential becomes obvious. Also, maximum flow can be computed.

LW has two courses. He can have boilers reclassified as low-pressure units to operate at 15 psig. New safety valves will have to be fitted. Or, second, he can keep boilers in their present classification (boiler inspector permitting) and run at 15 psig. Safety valves to relieve at slightly higher than 15 psig are advisable.

Classifying the boilers as l-p heating units introduces several economic advantages other than fuel savings. Local codes usually permit a reduction in number of operators, and there should be a substantial decrease in insurance premiums. This may be as much as 50%. Cost to convert boilers to run and be classified as l-p heating units is less than converting for 15-psig operation while remaining power boilers.

Code for Power Boilers applies to any unit operating at a pressure above 15 psig. If safety valve is set above this pressure, unit is classified as a power boiler. He can base safety-valve capacity on some pressure above desired operating pressure. Setting then becomes allowable working pressure.

To conform to Code without reclassification, relieving capacity for stoker-fired firetube boilers must be at least 7 lb per hr per sq ft heating surface. Assuming this boiler has about 1450 sq ft of heating surface and runs at 15 psig with safeties set at 16 psig, output would be 10,150 lb per hr. This is also the minimum allowable relieving capacity. Minimum area of boiler opening or safety-valve connection, based on Code requirements, is 45.8 sq in. The two existing 3½-in. safety valves have a total opening area of 19.8 sq in. if connected to a 3½-in. pipe.

To furnish additional area needed, Code permits installation of extra valves on the steam line between boiler and main stop valve except when boiler has a superheater.

Assuming steam outlet on boiler is same size as nonreturn valve, or 6 in., additional area can be provided by inserting a tee at boiler outlet and connecting safety to it. If a 6-in. tee is used, area obtained is more than adequate when area of two existing valves is added to it. Code requirements will be met.

If the two existing safeties are the type ordinarily fitted on firetube boilers, I estimate their capacity as about 6800 lb per hr at 125 psig. These two valves can probably be used at 15 psig if manufacturer changes the springs and provides increased lift off seat. Using Napier's equation, each valve's area should be at least 2.18 sq in. to pass one-third the steam generated, or 3385 lb per hr. Ask manufacturer if required effective discharge area can be obtained. New valve must have capacity equal to each of the others.

At 16 psig, catalog data show maximum capacity of 3½-in. valve is about 1500 lb per hr. So if existing valves cannot be converted, a new valve with a capacity of 7150 lb per hr is needed. A 6-in. valve on the tee would be suitable.

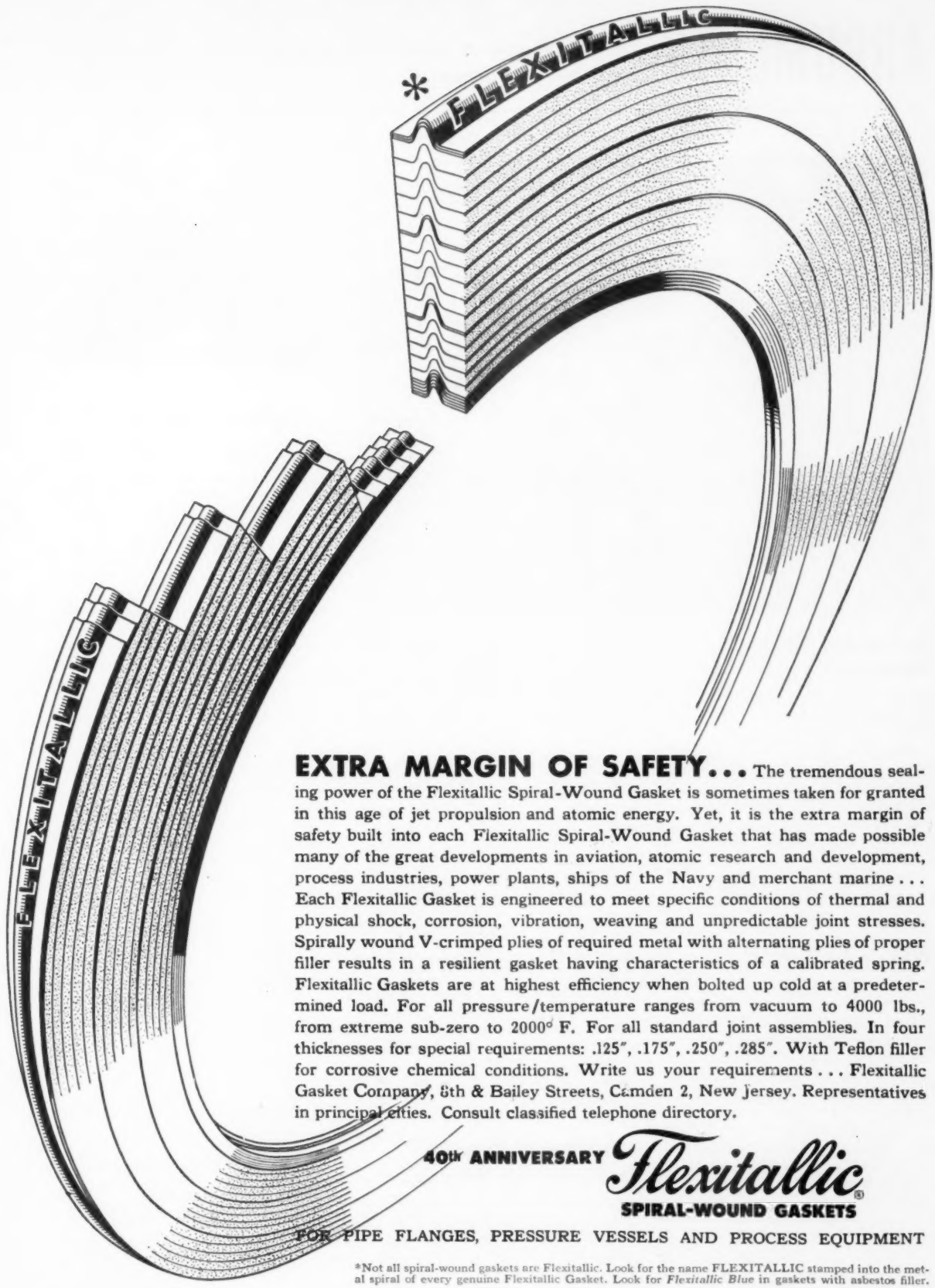
Computing relieving capacity needed if boilers are reclassified as l-p heating units, we find it is 7250 lb per hr, based on Code requirements. Existing safeties could be replaced with two valves made for heating boilers, each rated 4550 lb per hr.

Though *LW* may agree with all these suggestions he should consult boiler and valve manufacturers and the local inspector before going ahead.

Change of nonreturn valve depends on whether boiler is reclassified. If it is classified a l-p unit, nonreturn valve should be replaced with gate valve of the outside-screw-and-yoke rising-spindle type. I don't think 6-in. nonreturn valve will operate at the 15-psig pressure. See valve manufacturer before taking valve out of the line.

Check pressure-reducing valve to see it has sufficient capacity to handle heat-

(*Continued on page* 210)



EXTRA MARGIN OF SAFETY... The tremendous sealing power of the Flexitallic Spiral-Wound Gasket is sometimes taken for granted in this age of jet propulsion and atomic energy. Yet, it is the extra margin of safety built into each Flexitallic Spiral-Wound Gasket that has made possible many of the great developments in aviation, atomic research and development, process industries, power plants, ships of the Navy and merchant marine . . . Each Flexitallic Gasket is engineered to meet specific conditions of thermal and physical shock, corrosion, vibration, weaving and unpredictable joint stresses. Spirally wound V-crimped plies of required metal with alternating plies of proper filler results in a resilient gasket having characteristics of a calibrated spring. Flexitallic Gaskets are at highest efficiency when bolted up cold at a predetermined load. For all pressure/temperature ranges from vacuum to 4000 lbs., from extreme sub-zero to 2000° F. For all standard joint assemblies. In four thicknesses for special requirements: .125", .175", .250", .285". With Teflon filler for corrosive chemical conditions. Write us your requirements . . . Flexitallic Gasket Company, 6th & Bailey Streets, Camden 2, New Jersey. Representatives in principal cities. Consult classified telephone directory.

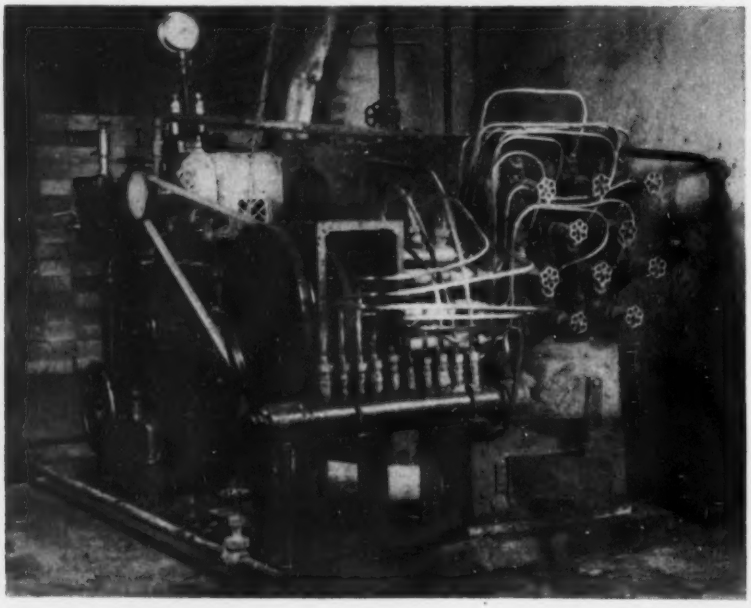
40th ANNIVERSARY *Flexitallic*®
SPIRAL-WOUND GASKETS

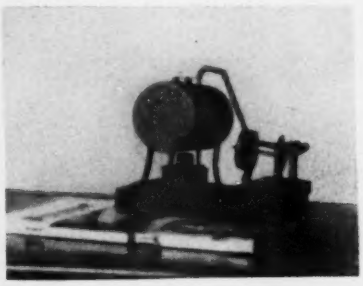
FOR PIPE FLANGES, PRESSURE VESSELS AND PROCESS EQUIPMENT

*Not all spiral-wound gaskets are Flexitallic. Look for the name FLEXITALLIC stamped into the metal spiral of every genuine Flexitallic Gasket. Look for *Flexitallic Blue* in gaskets with asbestos filler.

ARGUMENTS

Here's the place to unload your gripes to editors, manufacturers and fellow engineers





Designer From Age 15

Tin-can steam boiler and engine, *above*, were made by R K Mukherjee, W Bengal, India, at 15. Boiler has safety valve but no water gage, is heated by methylated spirit lamp. Its oscillating single-cylinder engine still runs.

Mukherjee, 30 years later, designed and built "flash" steam generator, *left* ←

Emergency Check Dangerous

EMERGENCY METHOD of checking water levels on the two boilers (POWER, Mar, p 128) is dangerous.

Blowdown lines are connected so water in boilers will equalize. There are two gage glasses on No. 2 boiler but none on No. 1. With this setup, if No. 1 boiler is fired at a higher rate than No. 2, all water can be forced out of No. 1. On the other hand, if No. 2 is fired at a higher rate, No. 1 can fill up and run over. This method requires the same steam pressure on both boilers.

With such a condition, it would be better to take one glass off No. 2 boiler and put it on No. 1. Better yet, keep a good supply of gage glasses on hand.

G ARTUS *Seattle, Wash.*

Weld Slinger on Turbine Shaft? Horrors, No!

I AM QUITE CERTAIN Alekna (POWER, Jan, p 130) will find turbine manufacturers throwing up their hands in horror at his suggestion. He wants to weld a slinger on turbine shaft to prevent steam blowing into fan bearing. This brings up possibility of starting cracks and eventually causing shaft breakage.

Most manufacturers rule that no welding be used on any rotating parts without special permission from their engineers. They even frown on electrical roughing-up prior to metal-spraying rotating parts.

One manufacturer for years installed a slinger that also served as a balancing ring. This was very effective, but the units were shrunk on the shaft.

R B WADE *Swampscott, Mass.*

Why Hard Surfaces?

RUSS KEMBEL SAYS in "Save That Surface" (p 103, Oct POWER) that critical surfaces should be protected with alloys. Steve Elonka says much the same thing in "Hard Surfacing," (Mar POWER). I don't agree with Russ. He may be a metallurgist, but I've been in charge (and still am) of maintenance in one of the largest utility plants in the country, and I use different methods.

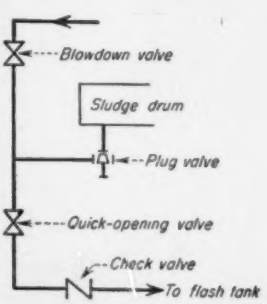
Why hard-surface your induced-fan blades? We always weld a section of floor plate over the blades. When they wear out, we merely remove the worn part and weld on a new one. The same with many other items. We find that welding on an ordinary wearing plate saves hundreds of pounds of expensive alloys.

If some reader can show me where I'm wrong, I'm ready to be shown. There are some places where alloys save us outages, but every time there must be a definite saving over our method before we'll change over.

C SOMMERFIELD *Chicago, Ill.*

Uses Check Valves In Blowdown Hookup

OUR BLOWDOWN HOOKUP is different from the one mentioned by H Ortner (March "Arguments"). We recently installed check valves on all our blowdown lines, see sketch at the right, because we have eight boilers on a common line to a flash tank.



Our experience has been that it is not necessary to open either blowdown

(*Continued on page* 212)

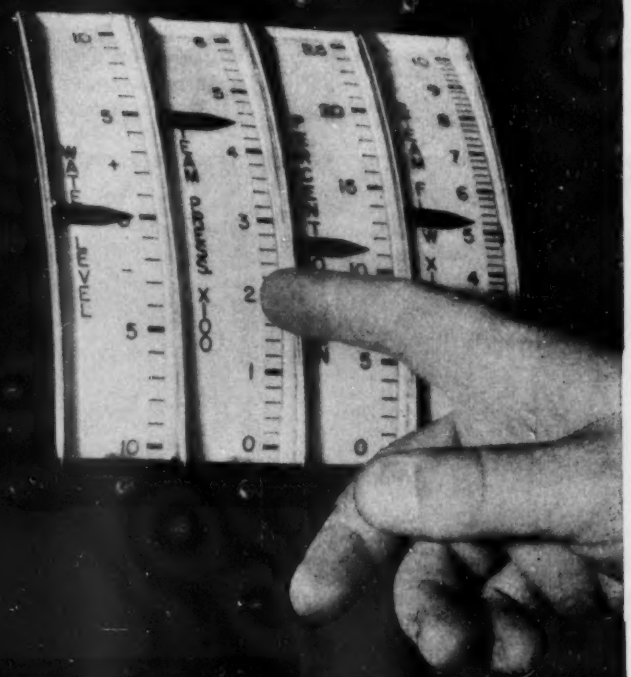
a new miniature indicator!

MEASURED VARIABLE — AIR-PILOT — COPPER TUBING

PNEUMATIC TRANSMISSION

MEASURED VARIABLE — DIFF. TRANSF. — AMPLI-FIER

ELECTRICAL TRANSMISSION



removable units—
interior illumination

easy to read—5 inch scale, no parallax

easy correlation of related functions

easy zero check from the front

HAYS Miniscale Gages

This miniature instrument is especially suited for remote indication of such variables as pressure, draft, flow or level.

The scale is only 5 inches long — easy to read — internally illuminated. Choice of pneumatic or electric transmission.

Also available is the Hays direct reading miniscale gage for indicating *pressures* of fluids (steam, water, gas, oil, etc.) directly.

Gages are arranged for flush or semi-flush mounting. Either a yoke mounting, for as many as 12 units, or a keyhole clamp mounting for individual units can be provided.

Write today for full information on the Hays Electronic Flow Meter Bulletin 52-1075-223.

Automatic Combustion Control
Boiler Panels • Hays-Penn Flowmeters
Veriflow Meters and Veritrol
Gas Analyzers • Draft Gages
Combustion Test Sets • CO_2 Recorders
Electronic Oxygen Recorders
Electronic Flowmeters
Electronic Feed Water Controls
Miniature Remote Indicators

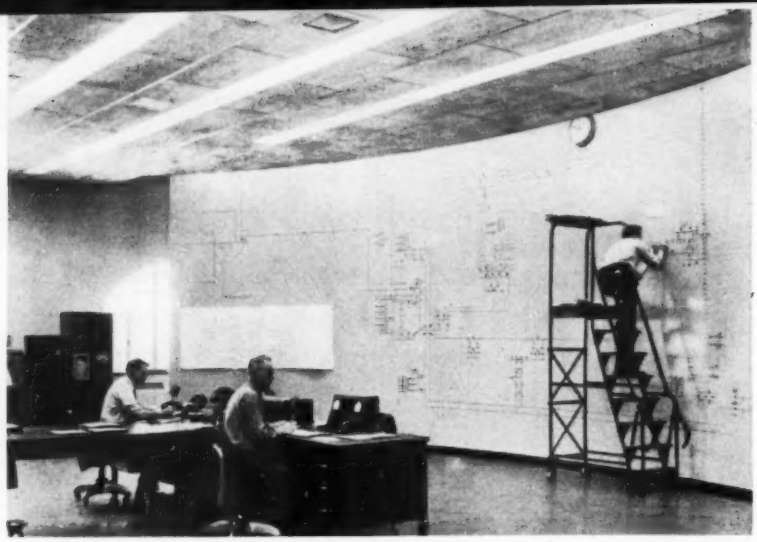
THE hays CORPORATION

MICHIGAN CITY 3, INDIANA

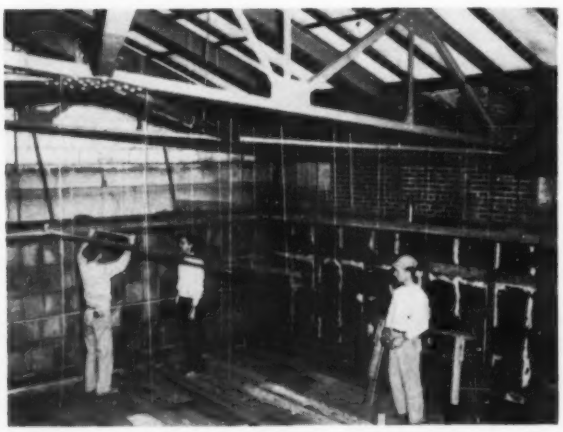
HOW TO

Hang Acoustical Ceiling Board

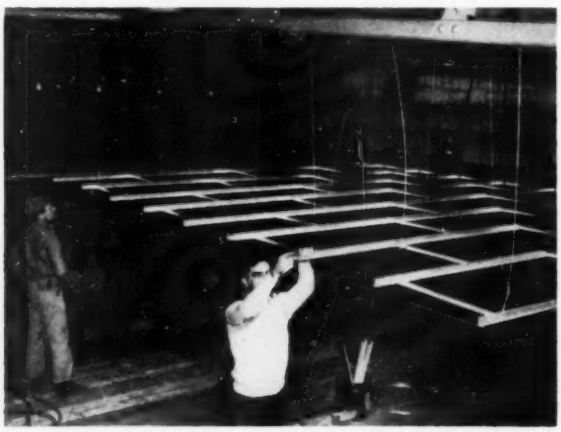
Courtesy, Owens-Corning Fiberglas Corp



LOAD DISPATCHER'S OFFICE at Toledo Edison power system is in old building that has been modernized with fiberglas acoustical ceiling board and recessed lighting



1 Level and cut center supporting-rib carefully for right length so it fits snugly at wall. Center rib is used as guide for other supporting ribs to be hung from the overhead for ceiling



2 While hanging grid system, be sure to check periodically for being level. Do this by suspending a chalk line as shown. After grid system is level, twist bottom wire ends

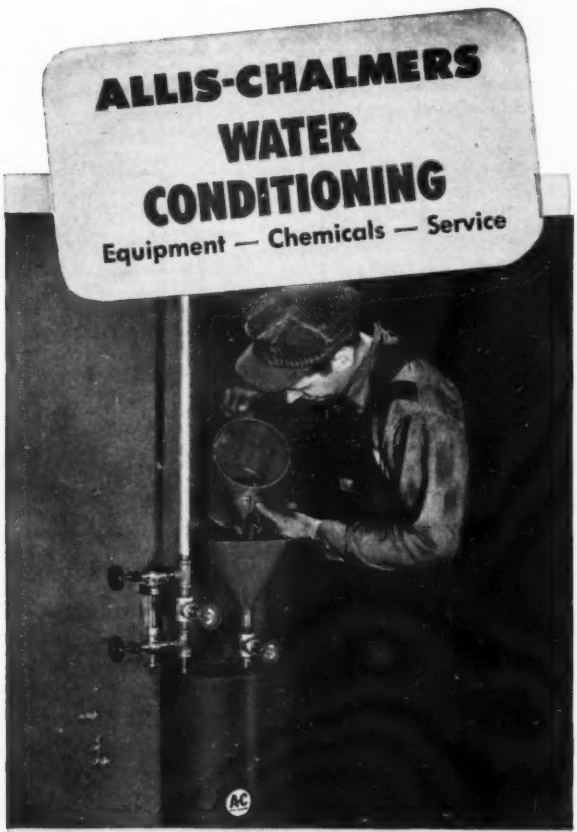
3 Install splice plate in ribs, either on floor, or after each rib is in place as here. Pliers squeeze ears flat to rib

4 After installing main supporting ribs, add 24-in. cross ribs. Insert ends through small slots, twist with pliers

5 When grid system is hung, slide the acoustical ceiling board into place. This operation is easy, and goes quickly

How to Solve Boiler Problems caused by

HIGH CIRCULATING RATES



Recent trends toward high circulating and high heat transfer rates mean that careful attention to water side protection of boiler surfaces will pay off in lower fuel costs and easier maintenance. Information that will help you analyze this problem and work out an effective solution is contained in Allis-Chalmers water conditioning Bulletin 43. It explains the problem. It tells what solution is available. And it tells how to apply this solution.

Based on Allis-Chalmers Experience

Bulletin 43 is one of a series of Allis-Chalmers bulletins on water conditioning problems. Each of these bulletins contains information that will help you solve some of your problems. They are based on Allis-Chalmers wide experience handling water problems for nearly every industry. In addition, they are based on Allis-Chalmers long experience building steam turbines and power plant equipment.

Complete Service Available

Allis-Chalmers gives you complete water conditioning service. You can get analyses and reports on your problems. You can get the chemicals needed in all water treatments. And you can get the equipment needed in any system.

A-4035

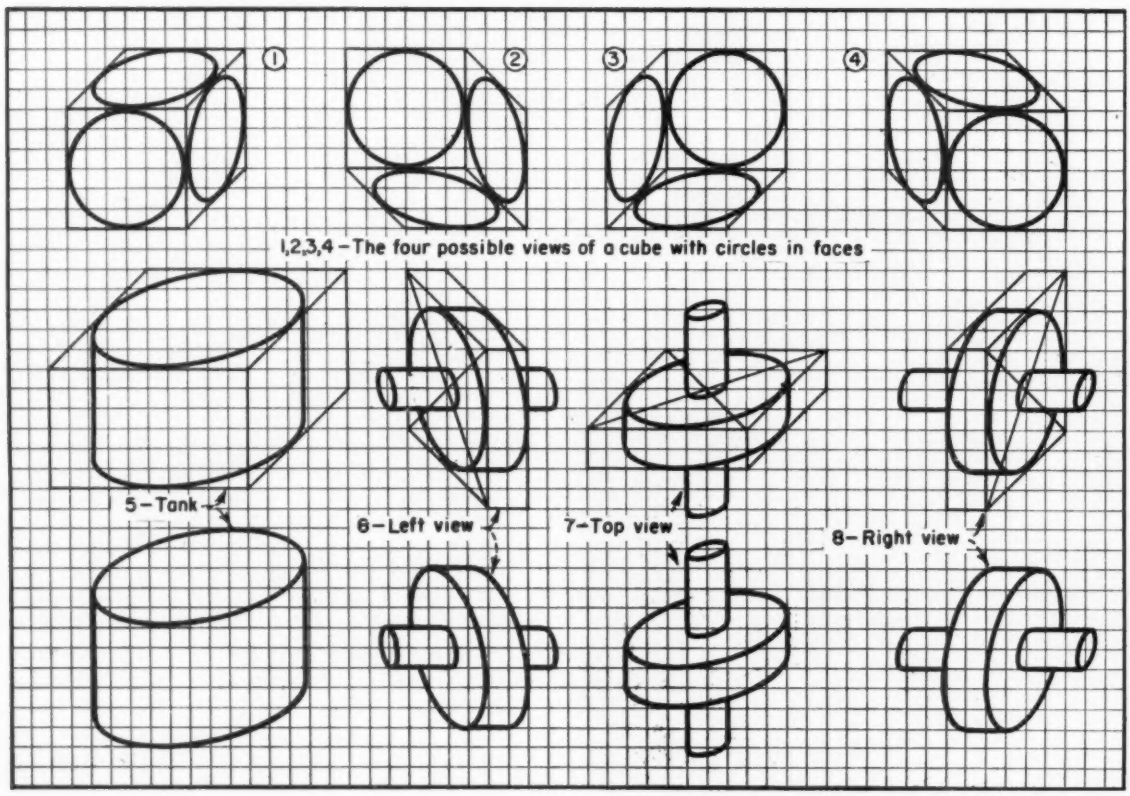
Equipment for all water treatments is available from Allis-Chalmers. Picture shows feeder installation similar to equipment used in water side protection of boiler surfaces.

For your copy of Bulletin 43 on internal treatment for water side protection of boiler surfaces, write Allis-Chalmers, Milwaukee 1, Wisconsin. Or better, call your nearby Allis-Chalmers district office and have an Allis-Chalmers representative consult with you on your water problems.

ALLIS-CHALMERS

HEADWORK

PHIL SWAIN BRINGS ENGINEERING THEORY DOWN TO EARTH



Easy Sketching System—9

► THIS MONTH and next we shall show how to save time and effort, and get a first-class job, using ellipse templates to draw oblique circles in cabinet projection.

Note that ellipses for isometric sketching are not thin enough for cabinet. You need special "25-deg tilt" ellipses, which should be so marked.

When ellipses represent oblique circles in cabinet we must admit the effect is somewhat less true, less pleasing than that of isometric ellipses. That's one reason why isometric sketching is a quality system, preferable to cabinet projecting where the finest style is required for exhibition or publication. Yet cabinet's greater convenience usually makes it preferable for many uses.

But if you choose cabinet, be prepared, now and then, to sketch an oblique circle, preferably with an ellipse template, such as all our sketches use this month and next.

Always draw the enclosing diamond first. Then find, on your template, largest ellipse that just fits in this diamond, tangent to all four sides.

Fig. 1, 2, 3, 4 show four possible views of a cube in cabinet projection. Note how ellipses fit into the diamonds representing top, sides, bottom of cube. For a given-size cube, you need only one ellipse, tilted to fit diamond.

In Fig. 5, first draw an imaginary square-topped box enclosing the tank. You have a 10-ft square (shown as a diamond) enclosing a circle (ellipse).

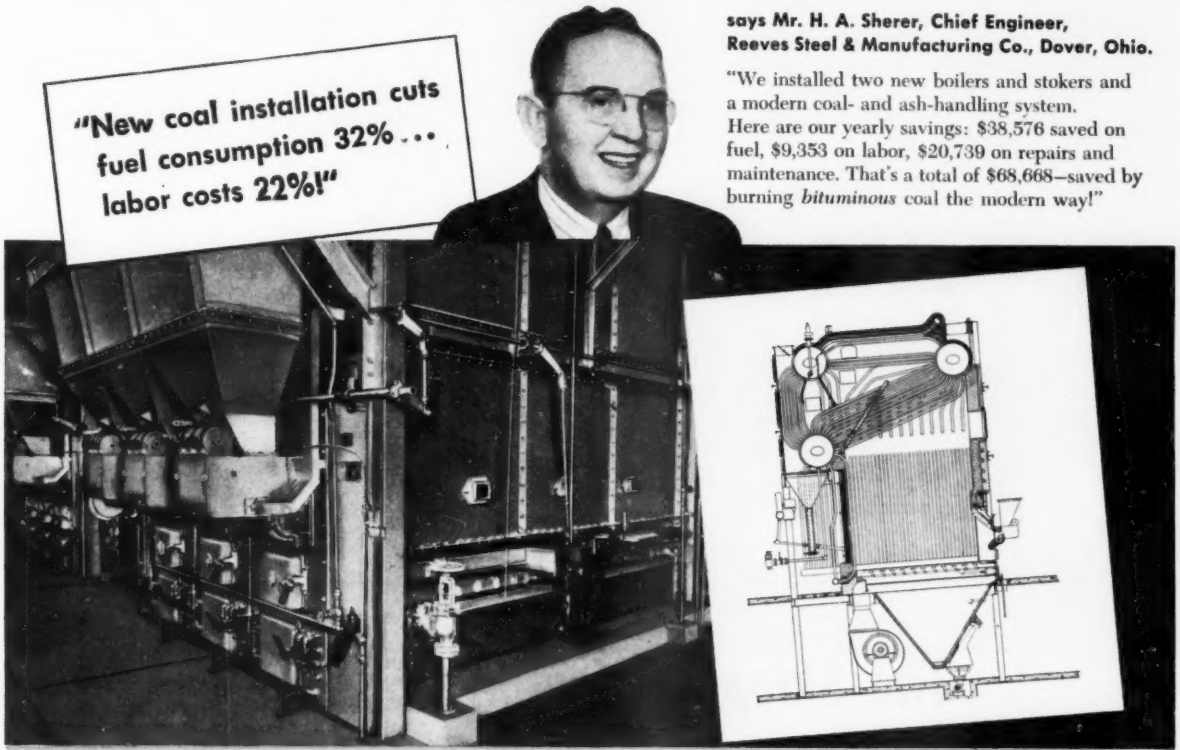
It's easy to fit ellipse in the top diamond, and move template straight down to make the tank's bottom edge.

Fig. 6, 7, 8 show how to draw a simple pulley and shaft in three positions. If you drew this shaft with end facing you, ends of both shaft and pulley would appear as a simple circle.

Next month we'll show how to draw a flanged tee using ellipse templates.

NOTE: *We suggest Dietzgen Truway Ellipse Templates from drafting-supply stores, or direct from Eugene Dietzgen, 218 E 23 St. New York, N. Y. For a template of 20 ellipses 1/8 in. to 2 in long, order 2275-25, about $2. For 12 ellipses 2 1/8 to 4 in. long, order 2275L-25, the price of which is about $3.50.*

"WE SAVE OVER $68,000 A YEAR— BY BURNING COAL THE MODERN WAY!"



says Mr. H. A. Sherer, Chief Engineer, Reeves Steel & Manufacturing Co., Dover, Ohio.

"We installed two new boilers and stokers and a modern coal- and ash-handling system. Here are our yearly savings: $38,576 saved on fuel, $9,353 on labor, $20,739 on repairs and maintenance. That's a total of $68,668—saved by burning *bituminous* coal the modern way!"

A view of the plant's firing aisle and a diagrammatic drawing of one of the boilers. It now costs 18.8¢ less to generate every thousand lbs. of steam. This is a saving large enough to amortize the entire installation in 3 years-3 months. And that includes all the cost incurred in tearing out old equipment and constructing a new plant floor!

● Today, *bituminous* coal's inherent economy has been greatly increased. Modern combustion installations give you more steam for every dollar . . . automatic coal- and ash-handling systems cut labor costs to a minimum.

A consulting engineer can show you how coal can do a better job—*and save you real money*—in a plant designed to meet your *specific* needs.

In addition, with coal you get the basic advantages of price stability, and dependable supply. These advantages are assured by America's virtually inexhaustible coal reserves and the high productivity of America's coal industry.

If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest cost fuel.

COAL resources in America are adequate for all needs—*for hundreds of years to come.*

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

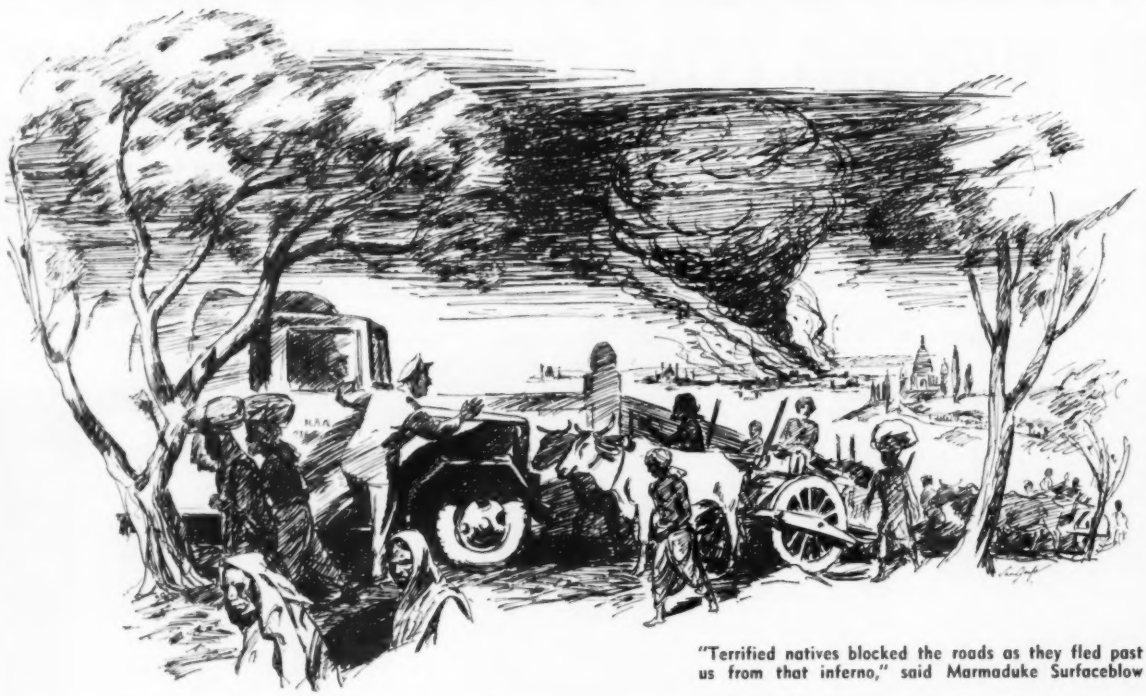
COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

BITUMINOUS COAL INSTITUTE

A Department of National Coal Association, Washington, D. C.

FOR HIGH EFFICIENCY FOR LOW COST

YOU CAN COUNT ON COAL!



"Terrified natives blocked the roads as they fled past us from that inferno," said Marmaduke Surfaceblow

The Skipper Wouldn't Scuttle

► THE OTHER DAY we ran into an engineer who complained that some of his department heads are too lax in giving orders. His squawk was that an otherwise capable chief engineer, for example, is a "good Joe" to the extent that he lets his men get by with murder.

"Maybe old Marmaduke Surfaceblow has a few thoughts on this subject," I promised when my friend got through crying in his beer. And next day I found myself climbing the creaky stairs to the old consulting engineer's office, above O'Houlihan's Machine Shop & Engine Works down near the water front.

The old boy was hard at work, jotting down sketches in a notebook. I cleared my throat as I walked through the open door.

"I'm told that some people just can't give orders and make them stick," I began quietly. "They don't seem to have what we in the Navy used to call that 'officer-like' quality."

"BILGEWATER ON GIVING ORDERS," roared Marmaduke, putting down his fountain pen and leaning back in his swivel chair. "Any jackass can give orders, but it takes a mighty smart engineer to TAKE orders."

Before I could open my trap, Marmy heaved his size 16 canal boats up on his roll-top desk, lit the short rope yarn sticking out of his face, shoved his old gray bowler to one side—then blasted away in his foghorn voice.

"During the war, in 1944, I signed on the freighter *SS City of London* as chief engineer. She was registered out of Vancouver, British Columbia. We loaded a cargo of high explosives, then shoved off for the Far East.

"It was one bright Sunday morning in April when we pulled into Bombay, India. That port was swarming with British and Canadian merchant supply vessels and navy ships. And as luck would have it, we tied up right next to HMS *Sussex*. It turned out that my old shipmate, Paul Hobson of Ottawa, was aboard her. After exchanging visits, the two of us got hold of an army truck Hobson needed spare parts so we drove to a repair base a few miles from the city. While out there we dropped into the British Officers' Club along the way for some English ale.

"We no sooner quenched our thirst than all hell broke loose. It started when a Canadian 'Fort' ship opened up her hatches to unload cotton. A Fort is the same as our Liberty ship but it is riveted instead of welded. She had about 1000 tons of explosives in her holds. When the longshoremen started unloading the cotton, they discovered fire in an adjoining hold.

"The ship's officers reported the fire to shore authorities, according to regulation. They came aboard and made a quick inspection. Trouble was in the ammunition hold because they found the bulkheads storing the explosives kinda hot. So the port authorities ordered the skipper to take his ship out to sea at once and scuttle her. But the skipper couldn't take orders. He was only good at giving them. 'I'm master and no tinhorn official is going to tell me to scuttle MY vessel,' he roared, growing purple around the gills.

"While the skipper argued with the gold braid from ashore, 35 very brave natives from the local water-front fire department descended into her hold to put out that fire. But a half hour later there was one blinding flash and a deafening roar. That was the end of the ship—explosives, crew and all.

(*Continued on page* 200)

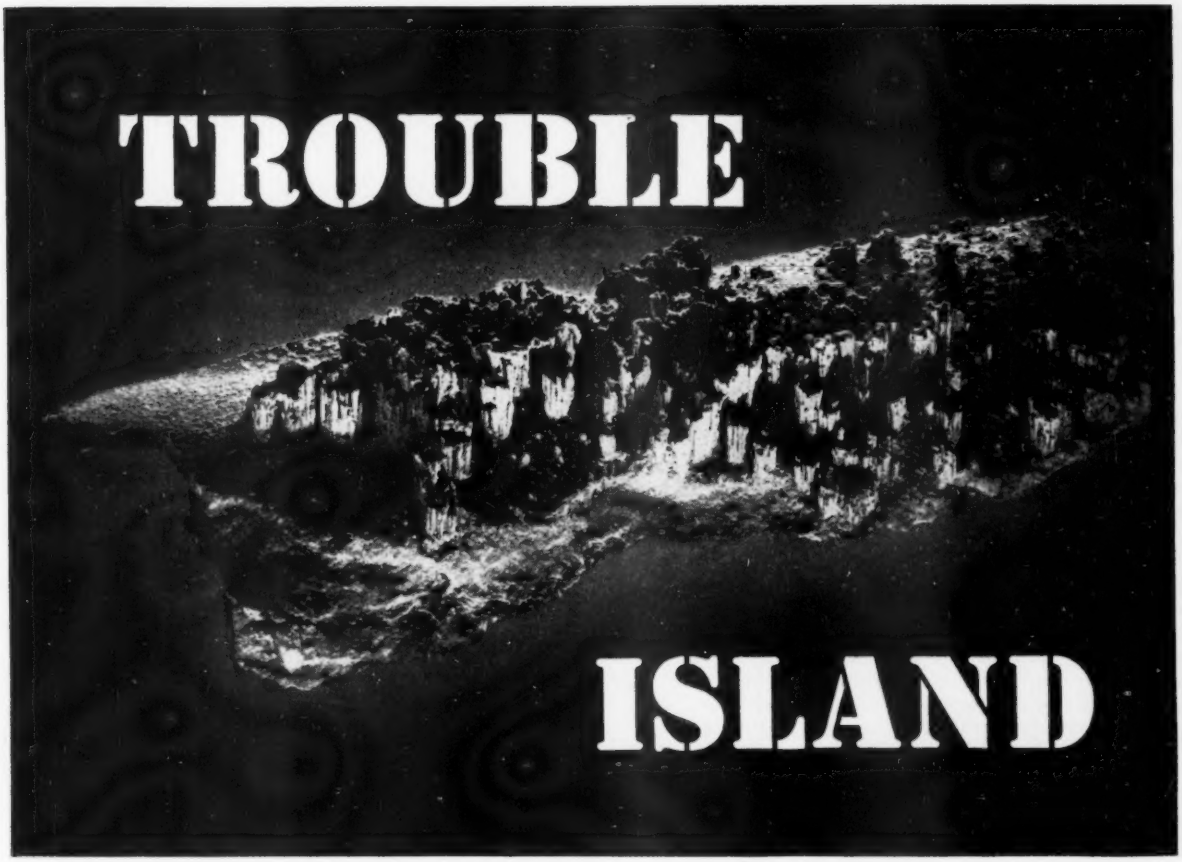


Photo is of a condenser-tube scale sample, about eight inches long. Solid scale is approximately ¼-inch thick, with "spires" ranging up to ⅜-inch height.

FIFTEEN years ago, this small island of trouble was part of a much larger open-box condenser problem at a refinery. Cooling water, running over 200°F. at outlet, contained 30 grains per gallon hardness and 20 parts per million iron. Tubes scaled heavily and rapidly without chemical inhibitor. Even with the best inhibitor then known, results were as illustrated above: partial inhibiting action creating the "spires" or forest-like deposits on tubes.

Considering this a challenge, Nalco sent a Doctor of Physical Chemistry—an expert water technologist—to the refinery. His weeks of work on the spot led to basically different treatment with new chemicals which cleaned up the condenser and kept it clean. Further Nalco research and development of chemical inhibitors has since enabled cooling systems to operate without scale or corrosion *with water hardnesses as high as 200 grains per gallon.*

Point is this: neither Nalco nor anyone else had an answer to scaling in that condenser. Nalco put the necessary brains to practical use and *got results* . . . benefiting, in the long run, not only that particular refinery, but every user of cooling water.

Whether your water treatment problem is unique, or stubborn plant-run, you will get prompt, decisive action from Nalco in the direction of positive results. Write or telephone today.

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Alchem Limited, Burlington, Ontario

THE *Nalco* **SYSTEM . . . Serving Industry through Practical Applied Science**

JENKINS PRACTICAL PIPING LAYOUTS 67

How to plan a

CONTINUOUS COLD LIME-SODA ASH WATER SOFTENING SYSTEM

The cold lime-soda ash process, in which the hardness factors, calcium and magnesium salts, are removed by chemically precipitating them, is one of the more common methods of softening water. This method is employed in virtually all major industries. Chemical and power plants, steel and textile mills, food and beverage processing plants, and laundries are typical users.

Depending on raw water requirements and composition, the cold lime-soda ash process may be used as an exclusive water softening treatment or as a single step in a series of treatments. It can be installed to operate as either a batch-process system or as a continuous-process system. The latter method has many distinct advantages—the foremost of which is less space and tank capacity to accomplish the same objective.

This continuous process system—sometimes called the "sludge process"—is illustrated in the accompanying diagram. Raw water enters a distributor and passes down to the mixing zone. There it mixes with the lime-soda ash solution pumped from the chemical feed system. Microscopic particles form which mix with previously formed coagulated sludge.

A paddle wheel improves the mixing and, at the same time, causes circulation of the water and precipitate. The circulation rate is five to six times that of the raw water flow. Thus, the mixture is in constant circulation, first rising through the mixing zone, then flowing down around the outside cone to reenter the mixing zone via the return port. Larger, denser masses of precipitate or sludge are not recirculated but instead drop down to be periodically removed by the desludging system. A small portion of the recirculating mixture passes up through the slurry and rises to the top. Then it passes through an orifice plate to the softened water trough, and proceeds to further treatment or use.

The desludging system is timed to function after a specific amount of raw water has been treated, this being based on operating experience. The operation consists of two parts. First, water is sent through the desludging header to loosen up the compacted sludge. This water is then shut off and a diaphragm-controlled drain valve opens to permit the watered sludge to drain out of the tank for a predetermined length of time.

Introduction of the lime-soda ash to the softening process is also based on the amount of raw water flow. A periodic analysis of the raw water will tell the operator to what degree he must alter the controls to allow more or less chemical feed for the amount of raw water.

Jenkins Fig. 651-A Iron Body Bronze Mounted Gate Valves are recommended for various supply and shutoff points in this system. The solid wedge and semi-steel body and bonnet provide maximum resistance to pressure strains. The through-port design of the body permits free flow without constriction. Operating threads are on the outside, allowing easy cleaning and lubrication. The rising spindle serves to indicate the position of the wedge, which is solid bronze in the smaller sizes, and cast iron with rolled-in bronze rings in the larger. The valve is equipped with renewable bronze seat rings.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the complete Jenkins line. It's your best assurance of *lowest cost in the long run.* Jenkins Bros., 100 Park Ave., New York 17. Sold through leading Industrial Distributors.

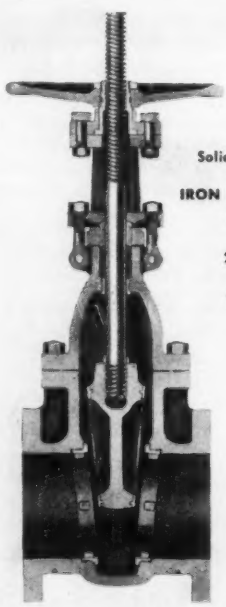
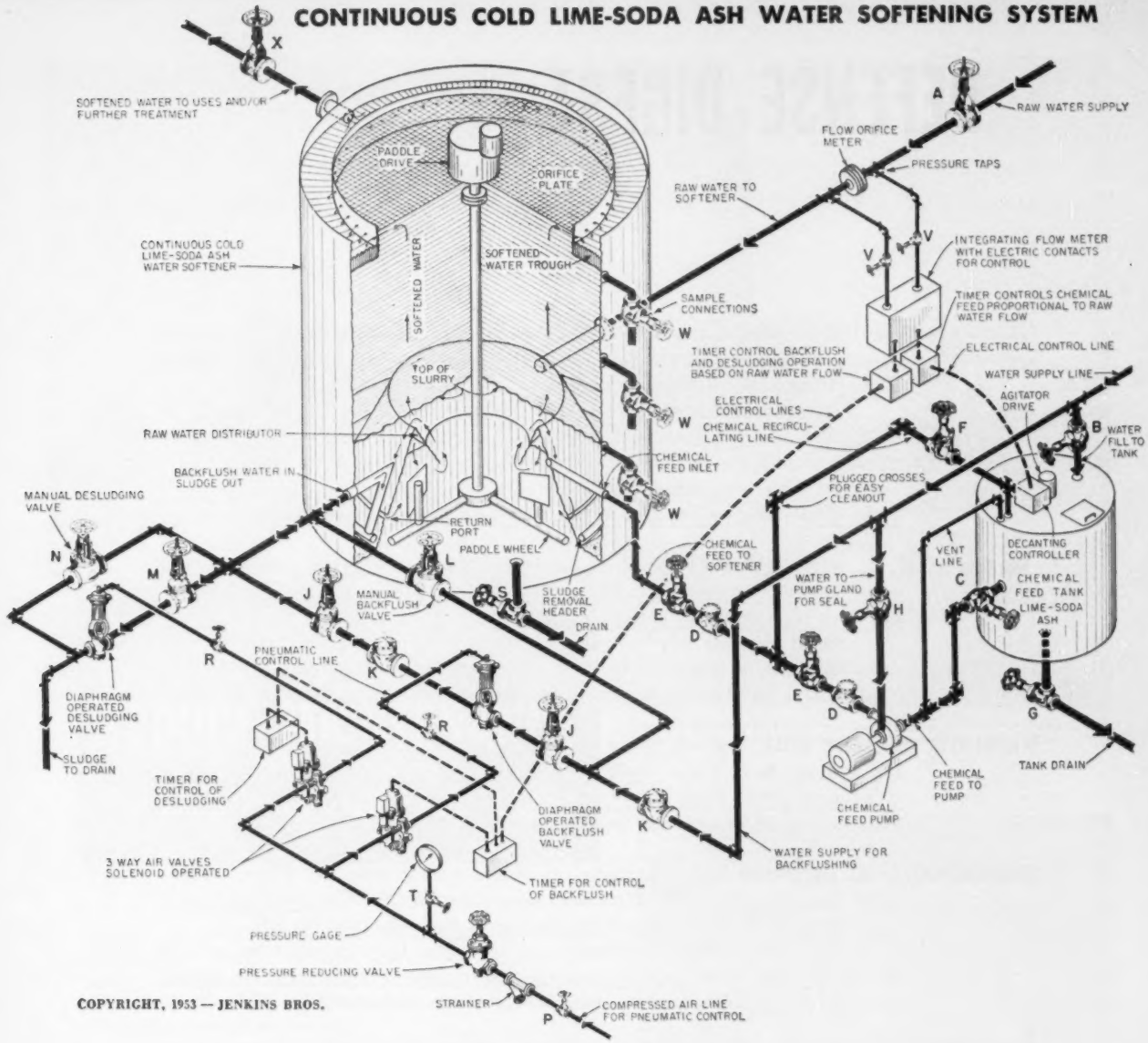


Fig. 651-A
Solid Wedge — O.S.&Y.
Rising Spindle
IRON BODY GATE VALVE
125 lbs. Steam
2" to 12"
200 lbs. O.W.G.
14" to 24"
150 lbs. O.W.G.

The *extra* measure of efficiency and endurance built into *all* Jenkins Valves is a distinguishing feature of Jenkins Iron Valves, which are made in a broad range of patterns and sizes. Yet *you pay no more* for this extra value. Compare the quality, and see why it pays to specify *Jenkins* Iron Valves.

CONTINUOUS COLD LIME-SODA ASH WATER SOFTENING SYSTEM



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VALVE RECOMMENDATIONS

For details of valves to suit varying conditions, see Jenkins Catalog

Code	Quan.	Jenkins Valve	Service
A	1	Fig. 651-A IBBM Gate	Raw water supply
B	1	Fig. 106-A Bronze Globe	Water Feed to chemical tank
C	1	Fig. 40-A All Iron Gate	Chemical feed to pump
D	2	Fig. 623 All Iron Swing Check	Prevent backflow
E	2	Fig. 40-A All Iron Gate	Chemical Line Shutoff
F	1	Fig. 40-A All Iron Gate	Chemical Recirculation Line
G	1	Fig. 75-A All Iron Globe	Chemical Tank Drain
H	1	Fig. 106-A Bronze Globe	Water to Pump Seal
J	2	Fig. 651-A IBBM Gate	Backflush Valve Shutoff

Code	Quan.	Jenkins Valve	Service
K	2	Fig. 624 IBBM Swing Check	Prevent Backflow
L	1	Fig. 142 IBBM Globe	Manual Backflush Valve
M	1	Fig. 651-A IBBM Gate	Desludge Valve Shutoff
N	1	Fig. 142 IBBM Globe	Manual Desludge Control
P	1	Fig. 106-A Bronze Globe	Compressed Air Line Shutoff
R	2	Fig. 106-A Bronze Globe	Pneumatic Control Line Shutoffs
S	1	Fig. 100 All Iron Gate	Softener Tank Drain
T	1	Fig. 741-G Bronze Needle	Pressure Gage Control
V	2	Fig. 741-G Bronze Needle	Flowmeter Pressure Tap Shutoffs
W	3	Fig. 75-A All Iron Globe	Sample Takeoffs

Diagram By Huxley Madeheim, Consulting Engineer

Illustrating the proved 3-point formula for trouble-free, time-defying hookups

A Use the right type valve for the service

B Place valves correctly in the line

C Choose Jenkins for lifetime economy

JENKINS
LOOK FOR THE DIAMOND MARK
VALVES
SINCE 1864
TRADE JENKINS MARK

Jenkins Bros

DEFENSE DIGEST

Your roundup of mobilization news and trends affecting power men

Changes in defense plans are taking shape as the Administration sizes up the new Russian regime and its program. These are likely to reflect a different strategic concept from that followed in the past.

Truman-administration planners tried to forecast the "danger year" in which Russia might move and gear defense build-up to meet it. Eisenhower's men seem to be figuring on maintaining a "respectable posture of defense" for a long pull – 10 to 30 years. This would probably mean holding a somewhat lower level of spending, one geared to sustaining a sound national economy.

Basis of U.S. strength is its economic potential, say proponents of this plan. Idea is to protect this strength in the face of a Soviet policy that will continue unchanged, regardless of "peace" manuevers.

But if shooting stops in Korea, there'll be pressure from the public and some members of Congress to slack off drastically on military spending and foreign aid. So sticking to the long-range program may prove pretty tough.

First big nuclear unit recently began low-power operation at National Reactor Testing station, Arco, Idaho. Built by Westinghouse as a prototype for submarine propulsion, power plant is rated at about 20,000 kw. A second unit, now under construction, is expected to go into a sub hull sometime in 1954.

Powdered-coal pipeline between Cadiz, in Ohio's mining area, and Cleveland, 135 miles away, looks good to Pittsburgh Consolidation Coal Co. They say they'll build as soon as customers can be lined up to keep pipe running full.

Line would move pulverized coal in water. Cost is estimated at $10 million but Pitt Consol expects to carry coal for less than $2.00 per ton against about $2.84 for rail shipment. Depending on flow, line would be 24 to 36 in.

Savings of nickel are promised by a new plating process. Developed by General American transportation Co. and called "Kanigen," it's a chemical method. It eliminates electrolytic equipment and is said to give equivalent protection with one-half to one-third the metal used in conventional processes.

Big future is seen in fields where usual methods aren't applicable. Kanigen is good for very large pieces and irregular shapes. It can be used for forgings and steel castings. Interiors of tubes and threaded parts can be coated uniformly, without pores. Valves and other small parts can be plated economically.

Zirconium for atom program will be produced at a plant to be built and run by Carborundum Metals Co. at Akron, New York, not Akron, Ohio, as we reported on this page in March. Plant is now under construction, will be completed soon.

Opening the atomic field to private industry is recommended in a plan to be put before Congress by the Atomic Energy Commission. It has approval of the administration and the National Security Council.

Key points: authority for AEC to sell, lease or lend fissionable materials, and for private concerns to design, construct and operate reactors to produce power. This would effectively end the complete Federal monopoly in the nuclear field. Experts believe security problems and patent policies can be worked out.

Sturtevant Fans

REDUCE MAINTENANCE

for Dayton Power and Light

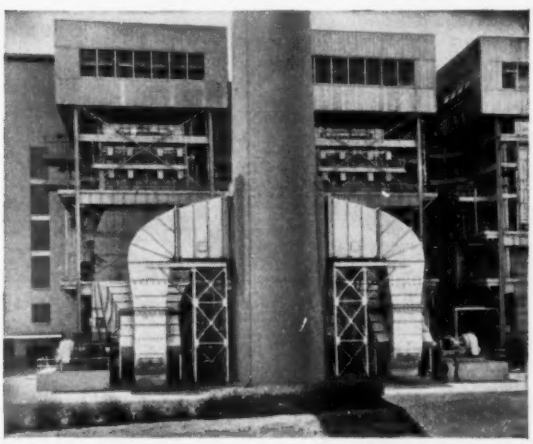
The O. H. Hutchings Station, 12 miles South of Dayton, will have six 60,000-kw units when completed in 1953. All FD and ID Fans in the Station are Sturtevant's famous Turbovane.®

At Dayton Power and Light's O. H. Hutchings Station, Sturtevant fans have a tough, long-running assignment. In four years, Unit #1 has burned 530,000 tons of pulverized coal in its dry-bottom boiler. Yet routine checks of the induced draft fans have shown that erosion is negligible.

One of the big reasons for this remarkable record is the time-proven Sturtevant E-R (Erosion-Resisting) wheel. Its special design causes fly-ash to use up its abrasive action on *itself*, and on replaceable liners. Result: many more years of fan life.

Sturtevant fans have also been chosen for the other five units of this important station. That makes a total of 6 forced draft and 6 induced draft Sturtevant fans.

If you want fans you can install and forget, choose Sturtevant. When you do, you get the plus benefit of 92 years experience in the power industry. Call your nearest Westinghouse-Sturtevant office, or write to Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Mass.



Expert engineering plus rugged construction of Sturtevant draft fans assure smooth, dependable operation. Exposed service such as this is particularly demanding.

YOU CAN BE SURE... IF IT'S Westinghouse

MECHANICAL DRAFT

J-80278

READER SERVICE SECTION

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TECHNICAL BRIEFS_____156
PLANT EQUIPMENT NEWS_____158
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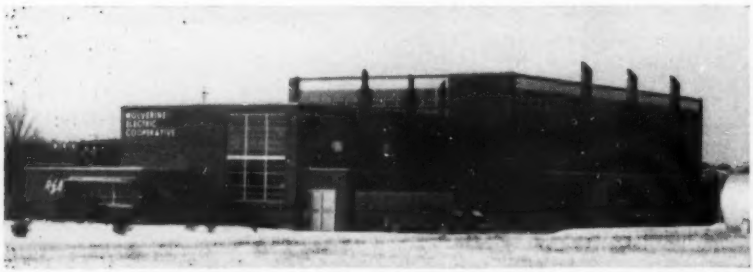


Wolverine Co-op's Johnson Plant Gets REA 1952 Efficiency Award

The Johnson generating station at Hersey, Michigan, base plant of the Wolverine Electric Cooperative, has been cited as "the most efficiently operated of all REA internal combustion plants" in 1952. With net generation at 27,932,460 kwh average production cost per net kwh was 5.96 mills.

Prime mover complement that helped earn this distinction includes three identical 3500 hp Fairbanks-Morse dual-fuel engines, two 1010 hp and one 1650 hp Cooper-Bessemer dual-fuel engines. Average operating engine load was under three quarters of rated capacity.

Pilot oil used is a blend of 70% gas oil and 30% No. 3 oil. Gas reaches the plant at 200 psi line pressure, passes through a heater and regulator and enters a 10-in. header at 55 psi. Pressure at engines is 35 psi for the Fairbanks-Morse units and 20.6 psi for the Cooper-Bessemers.

Getting natural gas for the Johnson plant was something of a problem since the Cooperative has been unable to buy transmission line gas from the utility serving Michigan. Intent on cutting fuel costs on their existing two engines, the Co-op in 1947 encouraged a local refining company to develop two small gas fields, one at East Paris five miles from the plant and the other at West Paris seven miles away.

Wolverine contracts for total production of the fields, and the plant's own line picks up gas at intersection of gathering system of the six wells. Actually, Wolverine contracted for the output of the East Paris field before the wells were dug.

As personnel get more familiar with the recently installed big engines, Wolverine speaks of even greater efficiency. This goal will be further helped by addition of aftercoolers, improved load factor, and a price drop in natural gas.

IGT Fellowships Increased

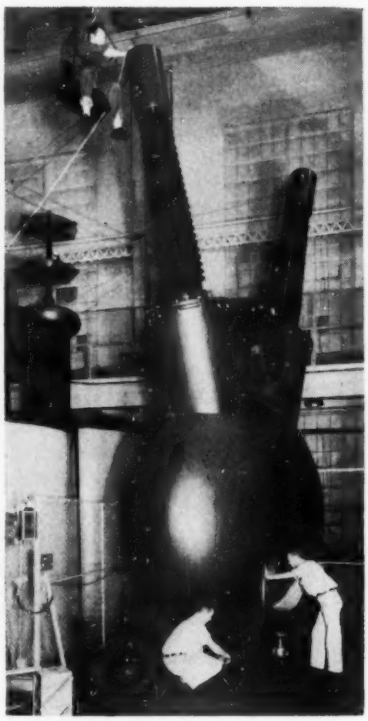
The Institute of Gas Technology, affiliated with Illinois Institute of Technology, Chicago, announces the availability of 15 Fellowships for 1953 leading to the degree of Master of Science in Mechanical Engineering or Chemical Engineering, or Master of Gas Techonolgy and Doctor of Philosophy.

The Master of Science curricula are additions which will accelerate the Fellowship program to enable earning a Master's degree in about 15 months instead of the two years still required for the Master of Gas Technology.

Applications are invited from seniors and graduates in chemistry, physics, and chemical, mechanical, natural gas and petroleum engineering who are in the upper quarter of their class, are U. S. or Canadian citizens and are under 28 years old. Application forms can be obtained from college department head, personnel manager of local gas company or from The Director, Institute of Gas Technology, 17 W 34th St, Technology Center, Chicago 16, Ill.

McGraw-Hill Surveys Expansion vs Modernization

The Economics Department of the McGraw-Hill Publishing Co has surveyed business plans for new plant and equipment over the next four years.



RECORD high 15,000,000 kva is interrupting capacity of 15 huge oil circuit breakers to be built at General Electric Co's Switchgear Department, Philadelphia. One of three pole units for one breaker is shown being readied for development tests. The breakers are also first 330 kv units built in United States

Here are some of the stated findings.

Businessmen plan to increase manufacturing capacity by 16 per cent between now and 1956. Biggest expansion is planned in the electrical machinery, transportation equipment and chemical industries, mining and utilities.

In many fields, however, increased production will result from modernization and replacement instead of actual expansion. On the basis of total capital spending, here are some figures showing the modernization shift:

	Per Cent Spent on Expansion		Modernization
1951	58		42
1952	49		51
1953	43	proposed	57
1954-56	38	proposed	62

In dollar-sign figures for overall cap-

(*Continued on page* 214)

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PERMANENT PIPE-LINE SECURITY

From *Master* Craftsmen come the world's finest *FITTINGS* . . . drop forged from solid billets of specially blended *STEELS.*

Your pipe connections can be harmonious and lasting . . . even endure beyond the normal life of the system . . . if proper consideration is given the compatibility of their meeting. Many millions of feet of pipe and tubing have been brought together by W-S Double-Diamond Forged Steel Fittings in lasting unions against time . . . heat . . . pressure . . . turbulence . . . corrosion . . . oxidation . . . vibration . . . reduction and shock.

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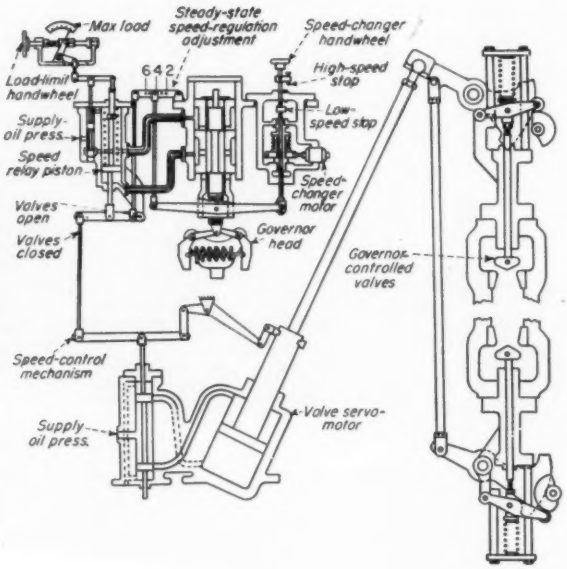
OWENS RIVER GORGE, above, has regular indoor generator inside special weather-proof housing. Lower portion, 16 ft high, is permanent; upper section, 12 ft high, has one-piece removable cover for maintenance. Crane also weather-proofed



GOVERNING SYSTEMS on modern steam turbines, right, operate almost without friction losses. Speed-sensing element works through a small pilot valve rotating in oil under pressure. Two oil relays, servo motors, amplify this action many times

Hydro Power

Electrical Features of the Owens River Gorge Project. *By O L Sidenfaden, Department of Water and Power, Los Angeles, Calif.*

The 112,500-kw Owens River Gorge hydroelectric development has 10.5 miles of tunneling, 3.5 miles of penstock and 260-miles of 230-kv transmission line. It consists of three 37,500-kw single-unit plants operating in series to use a total head of 2400 ft in three 800-ft steps. These plants use the water stored in Crowley Lake reservoir. A long pressure tunnel and short penstock connects this reservoir to the Upper Gorge plant. A second pressure tunnel connects the tail bay of this plant to the surge chamber and penstock of the Middle Gorge plant. A pressure tunnel, syphon and long penstock form the water channel from the Middle to the Control Gorge plant. The Upper and Middle plants are controlled by supervisory control from the Control plant.

Each plant consists of a 51,200-hp turbine, its generator, 11-kv switchgear, step-up transformer bank, synchronous bypass valve and auxiliary equipment. The generator, 11-kv switchgear and all 230-kv equipment are installed outdoors. A control house is provided for the supervisory-control equipment, automatic and manual start equipment, relays and station service equipment. Auxiliaries are located in the space below the generator deck.

The Control and Middle plants are now in operation and the Upper plant will go on line this spring. Test and operation of the two completed plants have been highly satisfactory and indicate that the use of outdoor construction, identical units and supervisory control of this project will fulfill the requirements set up at the start of design engineering. *AIEE Paper No. 53-23.*

Design Features of Automatic and Supervisory Control of the Calgary Power, Ltd, Hydro Electric System. *By T E Cardell, M W Clarke and H Randle, Calgary Power, Ltd, Calgary, Alt., Canada.*

The author's company plans centralized control of its eight hydro-electric plants and the transformer and switching stations on its main 138-kv transmission system. Six of these plants and their substations are now in operation as unattended plants controlled from a central dispatching station. Representing about two-thirds of the company's 156,000 kw hydro generating capacity, they range from 4000 to 50,000 kw rating. These plants are parts of an interconnected system with 281,000 kw total capacity in ten hydro and six steam plants. A 20,000 and a 30,000-kw plant are now being converted to remote operation.

A 12,000-kw single-unit plant, completed in 1947 was designed as a semi-automatic supervisory controlled station. Success of this plant led to the conversion of a 20,000-kw station in 1949, which also involved automatic control of a three-unit pumping installation. A development of three plants in series hydraulically, totalling 74,000 kw and using a head of 1300 ft was designed for automatic and remote control and completed in 1951. Cost of the automatic and supervisory equipment to date is less than the estimated cost of housing accommodation for manual operation of the plants.

Protective features, synchronizing,

How to make packings last longer

Tips by Johns-Manville Engineers to help you keep production rolling

Keep equipment in repair for best packing service

Worn shafts wear me down

Trying to make packing compensate for excessive shaft or rod wear will shorten packing life materially without alleviating the undesirable condition. Pack correctly to avoid excessive shaft and rod wear. Replace worn shafts and rods as soon as possible to avoid adding the expense of damaged packings to the cost of parts replacement.

"Bucking" shafts throw me!

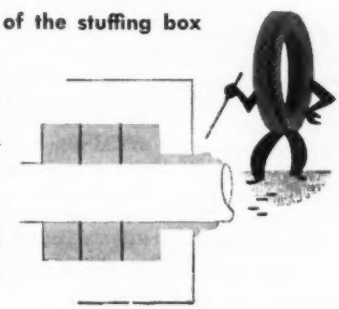
Packings are for sealing only. Trying to compensate for shaft misalignment or vibration by overpacking and excessive gland pressure results in scored shafts and ruined packing. Think of a stuffing box as a potential brake assembly that may develop considerable frictional resistance with attendant heat and wear.

Keep my lantern clear

If the stuffing box is equipped with an oil, grease or water lantern, its purpose is defeated when the lantern ring is omitted or the opening blocked by improperly installed packing or other obstruction. This can deprive the packing of lubrication or cooling and result in premature failure.

Don't let me get out of the stuffing box

If the shaft or rod is badly worn, the packing may be extruded into the system when the gland follower is taken up. Considerable difficulty such as packing getting into valves or traps or contaminating the fluid handled may result. Rebush the stuffing box or use a junk ring to reduce the clearance.



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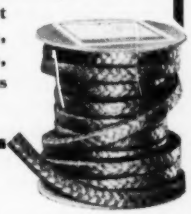
Made from long fibre asbestos yarn, plaited (not pressed) square, thoroughly lubricated and graphited, J-M Centripac has been, for many years, a preferred high-quality packing for centrifugal pumps and other equipment with rotating or oscillating rods. You can count on it to stand up against water — fresh, salt, hot or cold — oil, ammonia, brine, gasoline and some weak acids and chemicals.



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Johns-Manville PACKINGS & GASKETS

Begins on page 156

governors, speed matching, automatic load and frequency control, penstock valves, circuit operation, audio or subcarrier equipment channels, emergency control, emergency power supply and other features are described.

AIEE paper No. 53-94 by the authors of this paper gives operating experiences with these automatic and supervisory controls. Capital and operating costs, performance of the automatic equipment, automatic plant troubles for 1952, troubles with operation of lamp indications, telemetering and megawatthour counters are presented. *AIEE Paper No. 53-95.*

Prime Movers

Prime Mover Speed Governors and the Interconnected System. *By P G Ipsen and J R Norton, General Electric Co.*

The operators of power generating equipment have long been aware of the fact that it would be desirable from a system control point of view to have all speed governors on their interconnected systems with reasonably similar steady-state characteristics. Normal load changes would then be shared by all units in proportion to their ratings and the action of supplementary controllers would be uniform. This would make system control simpler and would result in smaller deviation of frequency and load distribution from the desired values. In most cases, attempts to make all prime movers on a system respond to system changes in proportion to their ratings have been confined to setting all the speed governors so that they have equal steady state speed regulation. Tests show that the response of prime movers to changes in system frequency or to the action of supplementary controllers is of a random nature and bears little relation to machine rating or to steady-state speed regulation. This paper will outline the factors that contribute to the random nature of prime mover response and indicate how testing programs for existing units, as well as future design changes of governing systems, can produce a major improvement.

The behavior of the speed governing systems on turbines in an interconnected power system can be understood only by defining and measuring their characteristics. These are defined in the AIEE 600 Recommended Specification, published in 1949. The more important characteristics are given below:

a. *Steady State Speed Regulation* is the change in speed when the power output of the turbine is gradually reduced from rated power output to zero power output with identical settings of all adjustments of the speed governing system. It is expressed in per cent of rated speed.

b. *Steady State Incremental Speed Regulation* is the rate of change of steady state speed with respect to power output at a given steady state speed and power output. It is expressed in per cent of rated speed when the difference is sustained speed, expressed in per cent of rated speed, for any two points on the tangent, divided by the corresponding difference in power output expressed as a fraction of rated power output.

c. *Dead Band* is the total magnitude of the sustained speed change within which there is no resulting change in position of the governor controlled valves.

d. *Stability* is the capability of the speed governing system to position the governor controlled valves so that a sustained oscillation of turbine speed or energy input to the turbine is not produced by the governing system during operation under sustained load demand or following a change to a new sustained load demand.

e. *Overspeed* is the maximum increase in speed from rated speed following a sudden reduction of turbine power output. Overspeed is expressed in per cent of rated speed.

Instruments are available which make it possible to determine any of these characteristics with reasonable accuracy. The performance of a governing system for a prime mover is most readily analyzed if it is considered to consist of two primary elements. 1. The speed sensing element or governor head and its relays including the servomotor. 2. The control valves which are positioned by the servomotor.

TO OBTAIN COMPLETE TEXT

Material for these abstracts comes from the following source unless otherwise stated. Order complete paper from source, not POWER.

American Institute of Electrical Engineers, winter general meeting, Statler Hotel, New York, N. Y. Jan 19-23, 1953. Identified by initials AIEE and obtainable through AIEE, 33 W 39th St, New York 18, N. Y.

The figure shows one type modern governing system for a steam turbine. The modern governor is designed to operate with a minimum of friction and the speed sensing element is required to move only a small pilot valve rotating in oil under pressure. Its movement is amplified many times by the two oil relays. Dead band and incremental regulation values should easily meet the recommended specifications. *AIEE Paper No. 53-55.*

Permanent Magnet Fractional Horsepower Motors and Generators. *By Wesley R Goss, General Electric Co.*

The evolution of use of permanent magnet materials in rotating machinery is chiefly one of magnet material and methods of processing and using this material. About twenty years ago alnico number II was beginning to be produced for commercial usage.

About 1945 we designed a number of ac alternators having multiple pole rotating magnetic fields. These were first designed with smooth non-salient pole, permanent magnets on which the polarity was impressed during magnetizing. These magnets were very difficult to heat treat and had to be magnetized, all poles simultaneously in a multiple pole magnetizer. These machines had very good wave form outposts but the magnet was not efficiently used due to the relatively short length between poles that could be magnetized effectively.

At first these machines were cast on steel sleeves with screw inserts which caused considerable amount of cracking in the magnets. To reinforce these cracked magnets, each one was surrounded with a stainless steel, non-magnetic banding ring on each end of the rotor. In order to eliminate this difficulty, a solid cast magnet without inserts was mounted by casting it in an aluminum jacket. This construction was satisfactory mechanically but required die casting equipment that was not economical for small production. They were still inefficient magnetically and de-magnetized quite easily. In order to use the magnetic material more efficiently, a redesign was made. In this construction, the flux was collected by a steel ring and fed to the air gap through fingers; all the North poles being fed from one end of the magnet; and all the South poles from the opposite end of the magnet. This made the magnet more uniform in cross section and length and was easily cast, magnetized and heat treated. In manu-

(*Continued on page* 222)

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Automatic minimum excitation provided by the *Regulex* voltage regulator permits generator operation close to the stability limit . . . much closer than manual operation allows. The sensitivity and exceptional response of the *Regulex* voltage regulator and associated equipment establish and maintain a safe ratio between generator load and field current . . . increase operating limits at any given power factor load . . . assure the best reactive kva division. This means maximum kilowatt output — more power to sell from your present capacity.

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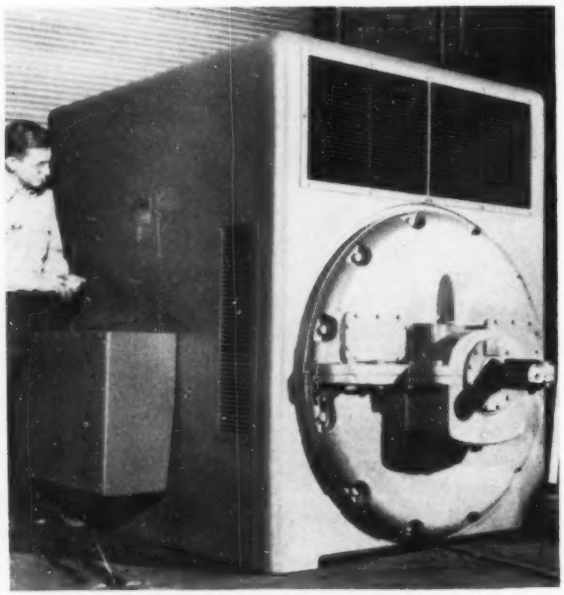


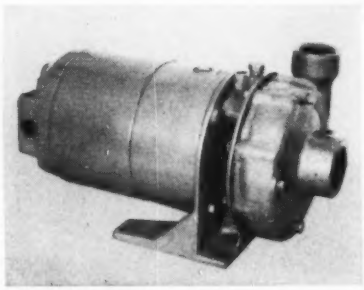
Boiler Feed Pump Motor

504 • New boiler feed pump motor for power generating stations is available in ratings 1000 hp and larger. It features improved ventilation system, cubical design, special high-speed rotor, and quieter operation.

Ventilation system discharges heated air away from workers and other nearby motors. Air is drawn in from motor's sides and expelled at higher level from shaft end over couplings and feed pump.

Overall width has been reduced by cubical design. High-speed rotor operates at 3600 rpm. Large air discharge chamber and louvered inlets and outlets contribute to quieter operation. Publication GEA-5813.

General Electric Co, Schenectady 5, N. Y.



Centrifugal Pump

507 • Close-coupled centrifugal pump, designated Fig. 3642 pump, delivers up to 110 gpm, operates at heads up to 110 ft. Electric drive motors range from ¼ to 2 hp. Discharge outlets are tapped to accommodate 1 or 1¼ in. pipe.

Motor and pump form single complete unit installed simply by bolting unit down and connecting piping and power. Impeller is single-suction type, threaded directly on extended motor shaft.

Casing is split vertically, and discharge nozzle can be turned to any one of eight positions. Interchangeable parts allow size conversion by changing only impeller and casing. Bulletin 624A3.

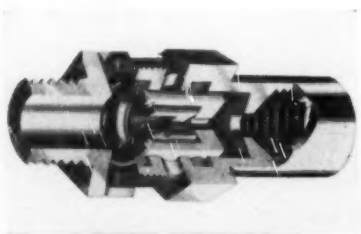
Goulds Pumps, Inc, Dept PR, Seneca Falls, N. Y.

Wrap-Around Insulation

505 • Pipe insulation is adaptable to hot and cold pipes of all sizes. Known as *Aerowrap*, new product is flexible and easy to apply on fittings, valves and pipes.

The insulation is a fine fibered blanket with special binder. It can be cut easily with shears, knife or paper cutter. Useful temperature range is from sub-zero to 600 F; thickness may be varied by wrapping.

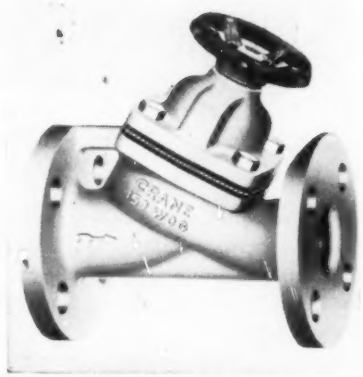
Owens-Corning Fiberglas Corp, Toledo 1, Ohio.



Quick-Release Valve

526 • Valve handles air pressure from 2 to 250 psi on pneumatic clutches up to 1500 hp. Its features include light weight and compactness; built-in orifice that prevents accidental removal of orifice from the line; double-piston design; no spring.

Deublin Co, Glenview, Ill.



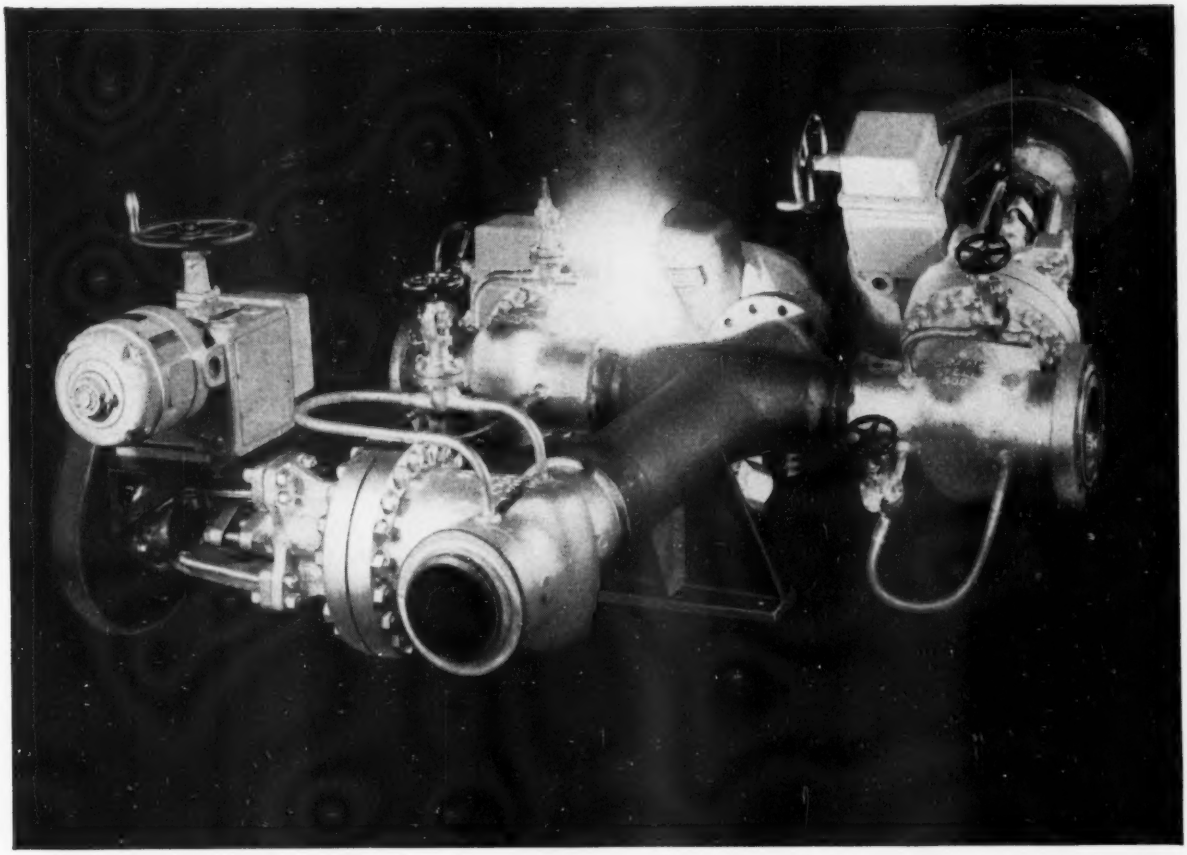
Diaphragm Valves

533 • Packless diaphragm valves are now regularly available with cast iron, brass, aluminum or 18-8 Mo bodies and disk holders, also with diaphragms and disk inserts of Neoprene, Buna-N, and soft natural hard rubber linings. Specially prepared valves for vacuum, oxygen and acetylene service are also regularly available.

Crane Co, 836 S Michigan Ave, Chicago 5, Ill.

(*Continued on page* 162)

For more data on these items, use post cards p. 169. Identify your request with item number



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Big Piping Savings for You—

The man behind the mask above is a *unit fabrication* specialist with a talent for saving you time, trouble—and dollars—in the long run.

He's part of a crew of experienced mechanics in one of the big Crane Fabricating Shops, where piping units like this 8-inch assembly are built *precisely* to specification.

And it's a complete as well as a quality service, for Crane takes over at the blueprint stage; supplies all valves and component parts—makes the pipe bends—does the welding. Right at hand are the best facilities for heat-treating or stress-relieving, radiography, etc., to assure uniform strength and dependability. The finished unit is pre-tested and proved in advance, ready for quick installation in your piping system.

You take no risk—you pay for no spoilages, and your erection crew is spared many a major headache. But, why not let your Crane Representative review your piping layout and help you decide where Crane Unit Fabrication will be to your advantage? There's also further information in your Crane 53 Catalog —or write for Folder AD-1771.

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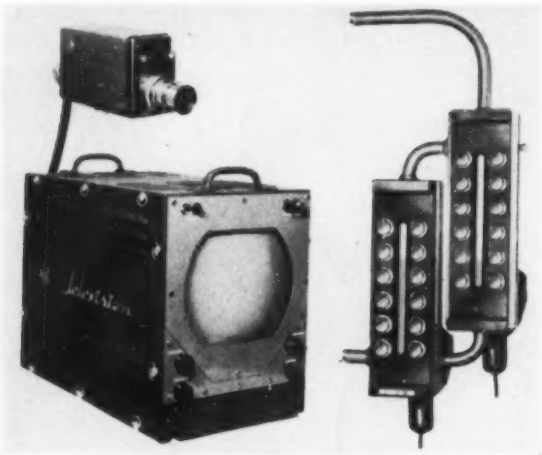
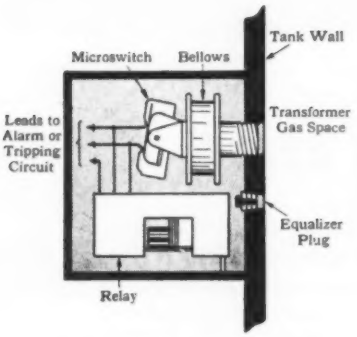


Televised Water Gages

553 • An arrangement between Radio Corp of America and Yarnall-Waring Co has resulted in application of RCA's Industrial Television to installations of *Yarway* Pressure Sealed Flat Glass Gages. Small, light-weight camera needs but single cable, has proper lighting built into special camera base.

Yarnall-Waring Co, Philadelphia 18, Pa.



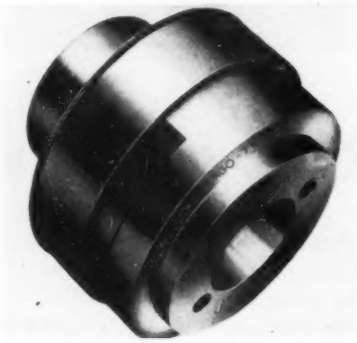
Sudden Pressure Relay

502 • Relay protects power transformers from internal faults. Operating on rate change of pressure, it is not affected by pressure changes common to transformer operation. In addition, manufacturer claims it more sensitive to small faults, quicker operating when large faults occur.

When an arc breaks down transformer oil, increased gas pressure is transmitted from transformer case to relay device through small tube. Pressure differential is throttled through tube and actuates a bellows.

Microswitch connected to bellows either sounds alarm or trips breaker to take transformer out of service. Manual reset switch provided.

Westinghouse Electric Corp, P O Box 2099, Pittsburgh 30, Pa.



Flexible Coupling

554 • Modified Type C coupling is a standard unit with one hub cut off. Three or more holes are tapped in the remaining flange, by which coupling is fastened to center of the flywheel. In all other respects, including collar, load cushions and inside sleeve, it is identical with the regular coupling.

Lovejoy Flexible Coupling Co, 5049 W Lake St, Chicago 44, Ill.

Liquid Level Indicator

555 • Miniature liquid level and valve position indicators are explosion proof, and designed to be mounted so indicating scales appear in distinctly shaped vessel or valve symbols on fronts of panel boards. Liquid level indicator is said to give illusion of actual sight glass. Actuation is by standard 3-15 psi pneumatic receiver.

Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Phila. 44, Pa.

Spray Sprinkler

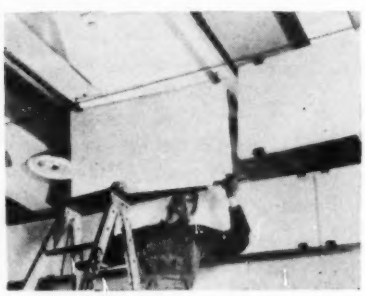
525 • Spray sprinkler features new deflector that departs from previous practice by directing no water at ceiling. New units produce higher proportion of fine droplets and distribute them in wide, evenly-filled pattern. Unit is listed by Underwriters Laboratories, Inc.

Grinnell Co, Inc, 260 W Exchange St, Providence, R. I.

Fire Extinguisher

521 • *Fyre-Freez* portable carbon dioxide extinguishers feature squeeze-type valves, and come in five sizes from 2½ to 20 lbs. Normal hand pressure actuates extinguisher after safety pin is removed. Carbon dioxide is approved for use on Class B (flammable liquid) and Class C (electrical equipment) fires.

Walter Kidde Co, 260 Madison Ave, New York 16, N. Y.



Noise-Stop Baffles

527 • Sound-absorbing, non-combustible *Fiberglas* baffles may be hung easily and quickly where a conventional acoustical ceiling is impractical because of obstructions like monorails, bus bars, pipes, etc.

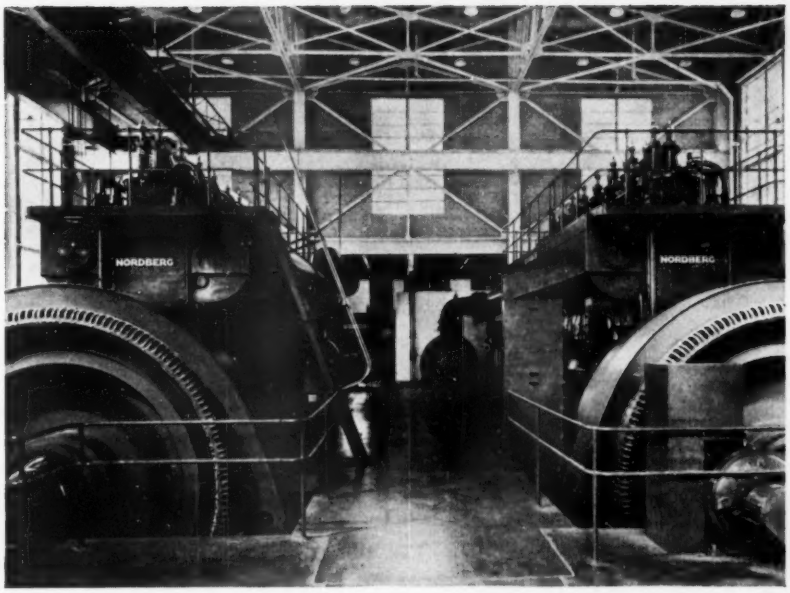
Baffles are made of fine fibers of glass bonded with thermosetting binder into rigid panels 24 x 48 x 1½ in., and enclosed in a plastic film. They are hung up by hooks on wires stretched across the area to be sound-deadened.

Owens-Corning Fiberglas Corp, Toledo 1, Ohio.

(*Continued on page* 164)

For more data on these items, use post cards p. 169. Identify your request with item number

W. T. Elliott,
Power Plant Supt.,
says...



"We've Got Facts to Prove Rubilene's Superiority"

A lot of people depend on Mr. W. T. Elliott. For it's his job as Power Plant Supt. to see that the City of Denton, Texas has unfailing light and power 24 hours a day. To help live up to that responsibility, Mr. Elliott pampers his hard working Nordberg Duafuel® engines — makes sure they're lubricated with the finest oil available. He says, "We've been using Sinclair RUBILENE® since 1948 with *very satisfactory results*. Cylinder liner wear is only ⅓ of 0.001 inch per 1,000 hours running. Piston ring life is 16,000 hours of operation and we get 6,100 H.P. hours per gallon of oil... Facts like those have definitely sold me on RUBILENE."

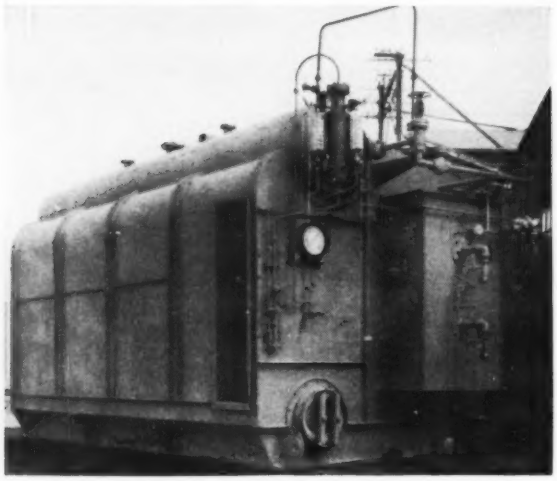
Why not let the facts prove to you, too, RUBILENE is a superior lubricating oil. Phone your local Sinclair Representative or write to Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR DIESEL LUBRICANTS

save wear and replacements

More EQUIPMENT NEWS

Begins on page 160



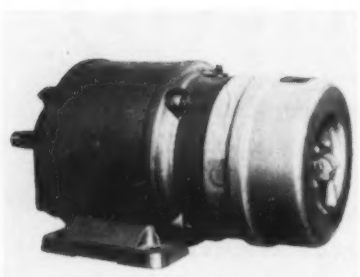
Package Steam Generators

508 • Package unit water tube boilers are enclosed in insulated, sectional steel casing. Unit requires only simple foundation and necessary service connections for operation.

Boiler is a two-drum longitudinally fired unit, with furnace formed by equally spaced U-shaped tubes rolled into steam and mud drums. Sidewall headers are eliminated. 36-in. steam drum and 24-in. mud drum are standard for all units.

Available in both induced and forced-draft design, boilers burn natural gas, oil or combination. Units are made in wide range of pressures for capacities to 30,000 lb per hr. Suitable for indoor or outdoor installation.

Henry Vogt Machine Co, Louisville 10, Ky.

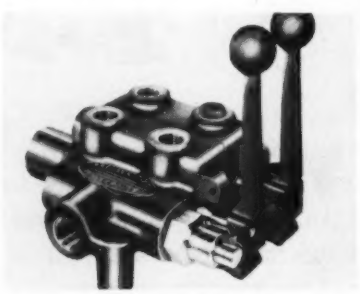


Magnetic Brake

522 • Fractional-hp magnetic brakes for standard ac or dc motors have torque ratings of 1½, 3 and 5 ft-lbs. Brakes self-adjust for wear, but critical torque adjustment can be made for precisely timed stops. Units have molded asbestos friction disks, and hand release.

Motor and brakes are connected in parallel. When motor starts, energized magnet operates to release pressure on friction disks. Stopping motor de-energizes magnet, freeing pressure plate, which applies pressure to friction discs, stopping motor. Brakes are fully enclosed and weatherproof; explosion-proof covers are available.

Dings Brakes, Inc, 4740 W Electric Ave, Milwaukee, Wis.



Hydraulic Valve

551 • Multi-control hydraulic valve for machinery of many types is designed to actuate two double or single acting cylinders or a combination of one single and one double acting cylinder. Center sections available that make additional control possible. Called the *Multi-Valve*, unit is fully balanced and self-centering, with built-in relief valve, adjustable from 20 to 1250 psi. Capacity is 24 gpm.

Gre-Sen Mfg Co, 628 Colfax Ave North, Minneapolis 11, Minn.

Silicone Varnish

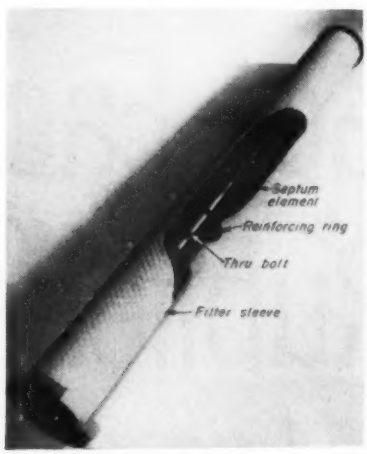
516 • New class H dipping and impregnating varnish No. 997 is said to have over 100 times the dielectric life of typical class B varnishes at 200 C, and to show even less tendency to bubble on curing. Total processing times are comparable to those required for class B machines and only ¼ to 1/7 as long as those previously required for class H equipment.

Dow Corning Corp, Midland, Mich.

Industrial Heaters

556 • Self-contained industrial heaters range from 100,000 to 2,500,000 Btu per hr in heating capacity, and from 2000 to 25,000 cfm in air volume. Unit may be floor, wall or ceiling mounted, and set either upright or inverted when wall mounted. Available accessories include filter boxes for built-in mechanical air cleaning and air-mixing boxes for controlled mixing of fresh and recirculated air.

Westinghouse Sturtevant Div, Dept T-535, 200 Readville St, Hyde Park, Boston 36, Mass.



Filter Element

501 • Water filtering element consists of heavy-built corrosion-resistant core on which is mounted a double-strength Vinyon sleeve. Among advantages claimed for this element are low head loss, quick and thorough cleaning characteristics, resistance to accidental damage. Sleeve is readily replaceable for easy maintenance.

General Filter Co, 923 Second St, Ames, Iowa.

Soft Asbestos-Neoprene Gasket

549 • Developed from asbestos and Du Pont Co's synthetic rubber, neoprene, the *Asbestoprene* gasket bridges gap between high temperature but hard asbestos gaskets and soft but low temperature cork and rubber gaskets.

Physical properties include: tensile strength, 1500 psi in machine direction, 500 psi in cross-machine direction; compressibility, 20-30% at 1000 psi loading; recovery, 40% minimum. Oil and gasoline resistance is also high.

Victor Mfg & Gasket Co, 5750 Roosevelt Road, Chicago, Ill.

(*Continued on page* 166)

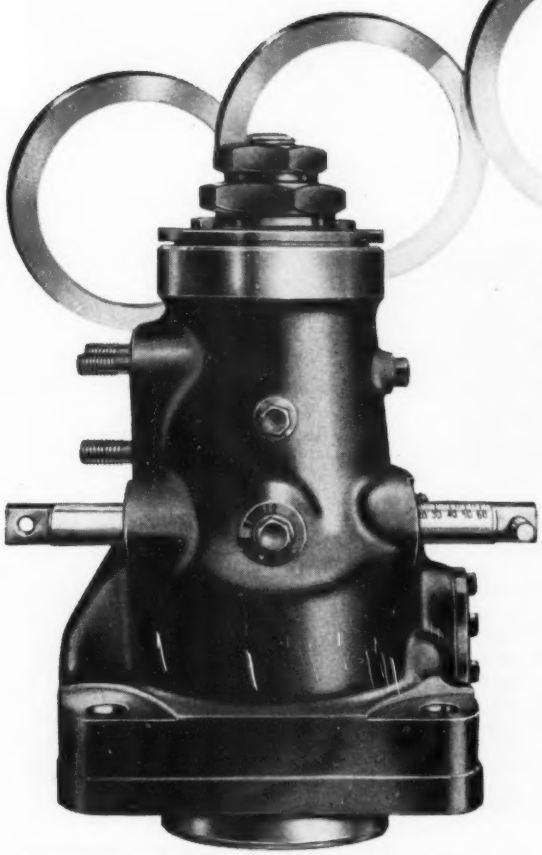
For more data on these items, use post cards p. 169. Identify your request with item number

TO MAKE HEAVY-DUTY COPPER

Gaskets

USE REVERE DEOXIDIZED

Tube!



Diesel Fuel Injection Pump, made by American Bosch Corp., Springfield, Mass., and gaskets made by cutting rings off 2" deoxidized copper tube.

• An important extra service rendered by Revere consists of collaboration in setting up specifications. This is valuable because there are many different Revere Metals, each with special characteristics. No one copper, for example, will serve to best advantage in every application. A case in point is the matter of copper gaskets for Diesel fuel injection pumps. Copper is of course an ideal metal for gaskets, and is widely used for that purpose. But for this special application, which copper and in what form? The pump is used on large engines for municipal generating plants. It weighs 186 pounds, and must produce the high pressure required to inject fuel near the top of the Diesel compression stroke. Naturally, the load is a pulsating one. American Bosch Corporation came to Revere with the problem. Our suggestion was that much scrap could be saved if the gaskets were made by cutting rings off copper tube, instead of stamping them from strip. This achieved a double purpose, since the tube is made of deoxidized copper, which is superior in this application to electrolytic. We are able to report that these recommendations proved successful. . . . This work was done by the Revere Technical Advisory Service. To get in touch with it, see the nearest Revere Sales Office.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

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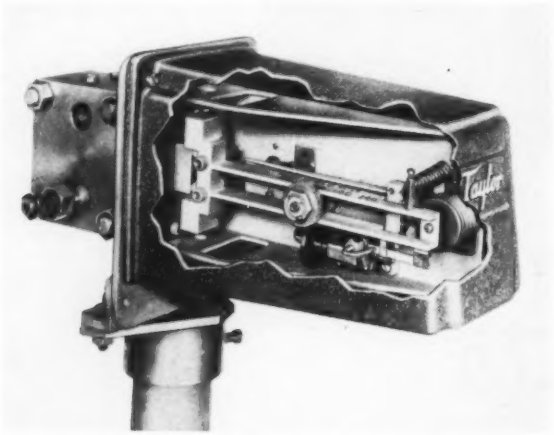
SEE REVERE'S "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS

More EQUIPMENT NEWS

Begins on page 160



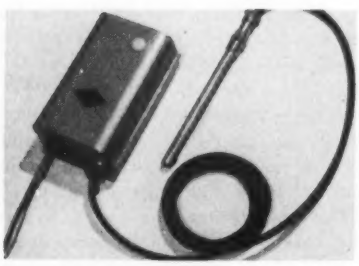
Differential Pressure Transmitter

537 • Force-balance transmitter is designed to convert differential pressure into an equivalent 3 to 15 psi output. It can be used to measure flow of liquid, steam or gas; liquid level or specific gravity.

Transmitter has two basic units, primary and secondary. Primary senses differential pressure and consists of a two-part, forged steel or stainless steel housing enclosing a Teflon-coated, glass fabric diaphragm. Inner housing is shaped to contour of diaphragm to permit full over-range protection of 1500 psi to either side of diaphragm. Secondary unit transmits proportional output air pressure, and incorporates a ruggedly constructed, pneumatic force-balance transmitting system. This unit is completely enclosed.

Advantages claimed for unit are simplified installation, easy maintenance, simple adjustment, built-in damper. Bulletin 98226.

Taylor Instrument Co, 95 Ames St, Rochester 1, N. Y.

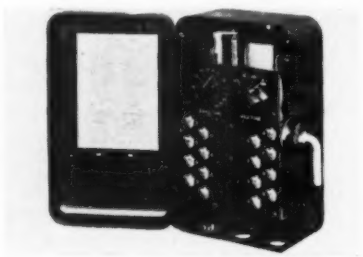


Electronic Liquid Level Control

511 • Based on capacitive action of liquid surrounding a porcelain-enamel-covered electrode, new *Belmont* control provides adjustment of liquid level and cut-in, cut-out differential over very wide limits, manufacturer claims.

Unit consists of probe mounted at location of controlled liquid, connecting cable 1000 ft long if necessary, and control unit located for operating convenience. Standard models operate from 115-v, 60-cps supply; special units for 230 v or 25 cps. Snap-action relay rated 10 amps at 115 or 230 v. Indicator light burns full brilliance when relay is open, half brilliance when relay is closed.

Thermo Instruments Co, 1166 El Camino Real, Belmont, Calif.



Electronic Timer

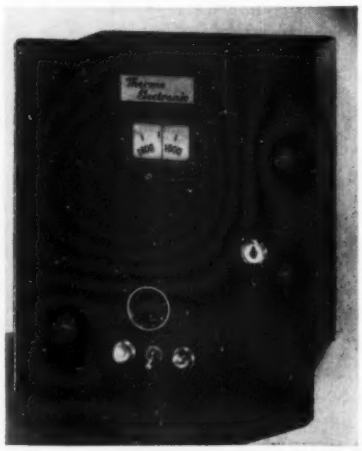
546 . Type 30HL1 is an automatic timer for intervals from 1/20 sec to 4 min, and provides four basic types of timing: interval, delayed action, automatic repeat and programming, as well as variations. All may be utilized by changing external connections to terminal board. Electronic circuit is self-compensating for voltage changes, has 2% limit of accuracy. Unit employs only one electron tube and one relay. 115 or 230 v, 50-60 cycles, 25 watts. Bulletin PC 5010.

Photoswitch, Inc, 77 Broadway, Cambridge 42, Mass.

For more data on these items, use post cards p. 169. Identify your request with item number

CHECK THESE TOO! . . .

Bolt heater . . . . . p 176
High-temperature thermostat . . . p 180
Adjustable speed drive . . . . . p 184
Roof ventilator . . . . . p 186
Drafting machine . . . . . p 190
Mechanical seal . . . . . p 192
Photoelectric counter . . . . . p 194
Right-angle gear drive . . . . . p 195
Turbocharged diesels . . . . . p 198

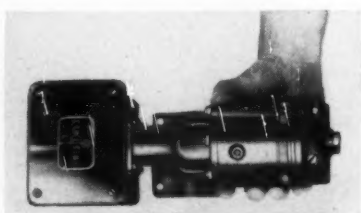


Electronic Pyrometer Controller

539 • Unit automatically controls temperature of batch processes or equipment suitable for two-position control action. Can be used with iron-constantan, chromel-alumel, or platinum platinum-rhodium thermocouples. Twelve standard scale ranges are available for controlling temperatures from 0 to 3000 F.

Controller has only one moving part—magnetic control relay—that throws positively when process calls for a change of heat. High sensitivity is maintained even on wide scale ranges. Calibration is said to be accurate within 0.25%. Unit operates on 110 v ac.

Thermo Electric Co, Inc, Fair Lawn, N. J.



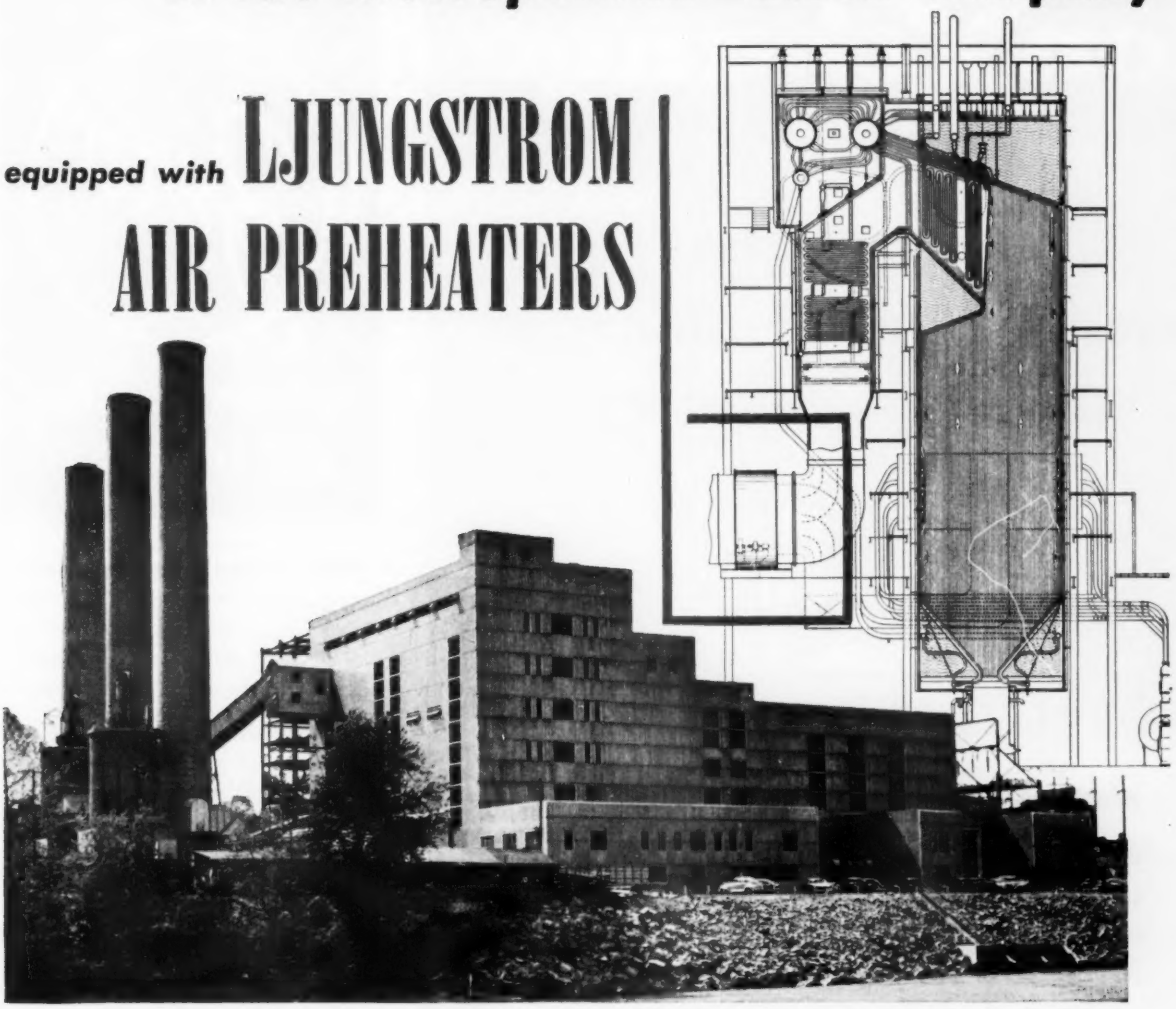
Pneumatic Transmitter

557 • Miniature pneumatic transmitter measures and transmits readings of temperature, pressure, vacuum, differential pres-

(*Continued on page* 176)

All three Boilers at New Titus Station of the Metropolitan Edison Company

equipped with LJUNGSTROM AIR PREHEATERS



Adding on completion 240,000 kilowatts to the output of the Metropolitan Edison Company of Reading, Pa., the company's new Titus Station is now in operation producing 160,000 kilowatts. Designed and constructed by Gilbert Associates, Inc., of Reading, Pa., Titus is expected to be in capacity operation early next year.

Steam for each of the two 80,000-kw turbine-generators now in service, and for the third, soon to go into service, is supplied by a Combustion Engineering–Superheater Boiler at 1450 psi and 1000 F, reheated to 1000 F. These C-E Boilers are pulverized coal fired.

Each Combustion Boiler has been designed to incorporate two Ljungstrom Air Preheaters which preheat incoming combustion air to 600 F, and cool exit gases to 280 F.

At Titus, as at scores of power plant installations across the country, once again the broad general acceptance of the Ljungstrom Air Preheater for top efficiency steam generating units is demonstrated. Ljungstroms placed in service or on order since 1945 alone — selected by every major boiler manufacturer, consulting engineer and utility — are serving boilers with an aggregate capacity of over 285,000,000 pounds of steam per hour.

THE Air Preheater Corporation 60 East 42nd St., New York 17, N. Y.

ILLCO-WAY

ionXchange

serving the essential power plants of American industry

pioneers and leaders in ionXchange

ILLCO-WAY "firsts" include manufacture of the first commercial two-bed De-ionizer . . . the first commercial mixed-bed De-ionizer . . . and the development and building of the first successful installations for the purification of such liquids as beet-juice and crude glycerol by ionXchange . . . In the power field, boiler feed water treatment by ILLCO-WAY ionXchange has long meant lower operating costs and increased operating efficiency. Installations in leading plants.

ILLCO-WAY

DE-IONIZING
DE-ALKALIZING
SOFTENING

For complete data, see Sweet's File, Power Plant

ILLINOIS WATER TREATMENT CO., 853-5 Cedar St., Rockford, Illinois
141 East 44th Street, New York 17, N.Y.
Canadian Distributors: Pumps & Softeners Ltd., London, Ontario

(Advertisement)

When

*Zero**

means success *not* failure...

***Zero in ionXchange** expresses any quantity below detection by normal laboratory procedures. Hundreds of ILLCO-WAY ionXchange installations are producing waters with zero readings.

Zero hardness Water of zero hardness is produced by ILLCO-WAY Softeners designed to meet your plant requirements. Operating range up to 260° F. Manual or automatic controls.

Zero alkalinity Water for plant and boiler feed, with zero or controlled alkalinity and zero hardness, is produced by ILLCO-WAY Hydrogen Zeolite equipment. Units designed to meet your requirements.

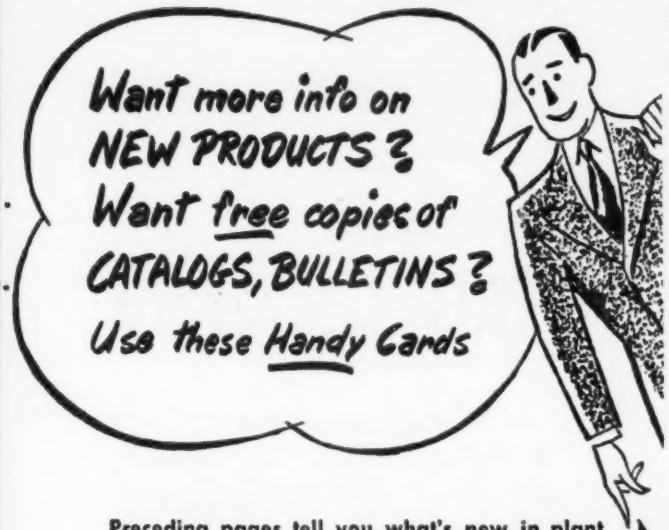
Zero solids Water of extreme purity—free of solids, CO_2 and silica—is produced by ILLCO-WAY De-ionizing equipment. "Package-type" units: 12 to 1,000 gph. Larger equipment specially designed; manual or automatic operation.

Send for your free copy . . .

of Bulletin "Zero," containing performance data, installation views. Please write on company letterhead. Address: Illinois Water Treatment Co., 853-5 Cedar Street, Rockford, Illinois.

Which "Zero" ?

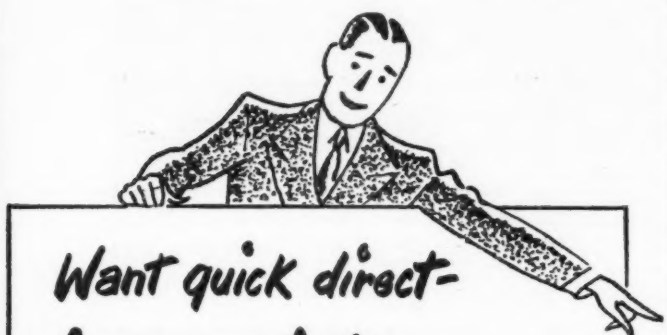
ILLCO-WAY



Preceding pages tell you what's new in plant equipment. Each item is numbered. For more info on any of them, write in their numbers here

New free catalogs and bulletins are listed beginning on back of this page. To order those you want, write in their item numbers here

Put 2¢ stamp on self-addressed card and mail it to us. We'll pass along your requests to the various companies, they'll send the info



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- **First check what you need: more information on a new product or an ad, copies of free catalogs, bulletins**
- **Then describe the product, or literature desired. Give model numbers, bulletin numbers wherever you can**
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Manufacturer's name

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Street address

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Company .....

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City, State .....

This month's FREE Literature

AIR CONDITIONING

★ **Service Manual**—for air handling and conditioning equipment, gives installation, operation and maintenance information. 68 pages. ★Request direct on company letterhead to Clarage Fan Co, 619 Porter St, Kalamazoo, Mich.

BOILERS AND ACCESSORIES

1 **Steam Accumulator**—to balance steam supply with demand, take fluctuating load off boilers. Bulletin RA-52-3, 8 pages. Foster Wheeler Corp, 165 Brodaway, New York 6, N. Y.

2 **Fuel Oil Treatment**—said to dissolve sludge, clean fuel tanks, fuel lines and heaters plus remove soot and scale from boiler fireside. 4 pages. The Sterling Water Treatment Co, 1920 W 77th St, Cleveland 2, Ohio.

3 **Regenerative Fly Ash Collector**—has no moving parts, consumes no power. Operates on pressure-velocity exchange with centrifugal flow. 6 pages. Breslove Separator Co, Commonwealth Bldg, Pittsburgh 22, Pa.

4 **Automatic Boilers**—oil or gas fired, 10 to 500 hp, 80% efficiency guaranteed. 4 pages, Form 102. Boiler Engrg & Supply Co, Inc, Phoenixville, Pa.

ELECTRICAL AND MECHANICAL CONTROLS

5 **Temperature and Conductivity**—controllers, temperature regulation up to 1000 F, conductivity to check condensate purity. 20 pages, Catalog ND47. Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 44, Pa.

6 **Rheostats**—50, 75, 100 and 150 watts, 0.50 to 10,000 ohms. Bulletin 353, 4 pages. Hardwick, Hindle Co, Newark 5, N. J.

7 **Thermal Time Delay Relays**—six time ranges, intervals from 3 sec to 5 min. Operating characteristic curves. 4 pages, Publication No. 30, G-V Controls, Inc, 28 Hollywood Plaza, East Orange, N. J.

8 **Electric, Pneumatic Controllers**—to measure and control a multiplicity of process variables. Detailed specs, control action descriptions, ratings. 56 pages, Catalog 1530. Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Sta 64, Wayne & Windrim Aves, Philadelphia 44, Pa.

9 **Steam and Liquid Control**—equipment includes pressure, temperature regulators, solenoid, diaphragm, motor operated, float, pop safety and relief valves, strainers and water gages. 60 pages, Catalog 53. O C Keckley, 400 W Madison St, Chicago, Ill.

10 **Recording Thermometer Controller**—with motor-driven set point index; operation, components, specs. 2 pages, Bulletin 501-S. Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Sta 64, Wayne & Windrim Aves, Philadelphia 44, Pa.

11 **Temperature Controls**—one, two and three switch models with some suitable to 1800 F. 4 pages, Catalog G-18. Burling Instrument Co, 5 Vose Ave, South Orange, N. J.

12 **Electromagnetic Controls** — and solenoid valves, a summary. 4 pages, Circular VS-50. Automatic Switch Co, 391 Lakeside Ave, Orange, N. J.

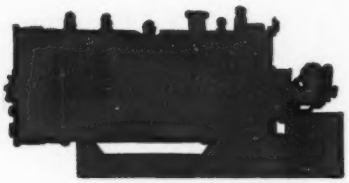
ELECTRICAL EQUIPMENT

13 **Motor and Generator Reference Book**—to assist in the selection of motive power to handle most industrial applications. 50 pages, 51R7933. Allis-Chalmers Mfg Co, 952 S 70th St, Milwaukee, Wis.

14 **Metallic Rectifier**—power conversion units, 125 to 250 volts dc. 8 pages, GEA-5655B. General Electric Co, Schenectady 5, N. Y.

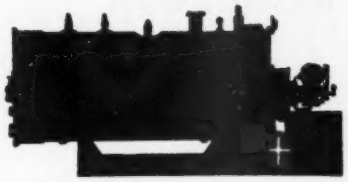
(Continued on page 244)

HOW SUPERIOR SOLVES YOUR STEAM PROBLEMS



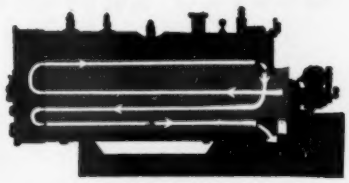
A COMPLETE PACKAGE

Completely factory-assembled and tested, a Superior Steam Generator is backed by undivided responsibility.



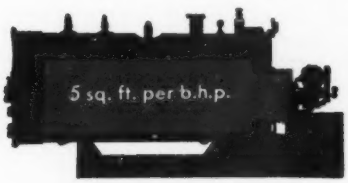
INDUCED DRAFT THAT'S BUILT-IN

...eliminates need of an expensive chimney... Multiple fans draw evenly on all tubes, reducing maintenance.



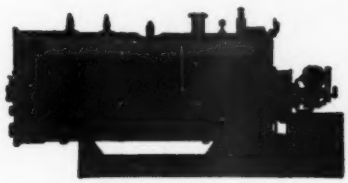
4-PASS, DOWN-DRAFT DESIGN

High gas velocities produce high efficiency. Down-draft design promotes rapid evaporation, quicker steaming.



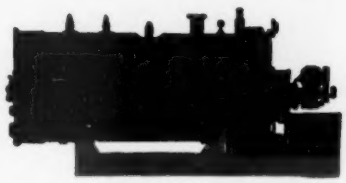
AMPLE HEATING SURFACE

A minimum of 5 sq. ft. of heating surface per boiler horsepower assures maximum efficiency at full rated capacity.



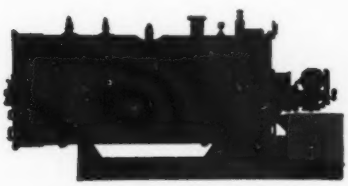
RESERVE CAPACITY

Greater steam space and large evaporating surface provide ample reserve capacity & better than 99% dry steam.



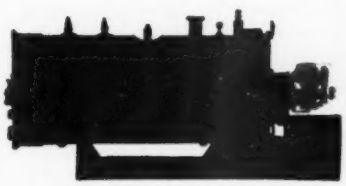
NO EXPENSIVE FOUNDATION

Built on a rigid channel iron base, a Superior Steam Generator needs only a floor capable of supporting its weight.



BUILT-IN CONTROLS

All controls essential to completely automatic operation are factory-wired into an easily accessible control panel.



BURN OIL, GAS, OR BOTH

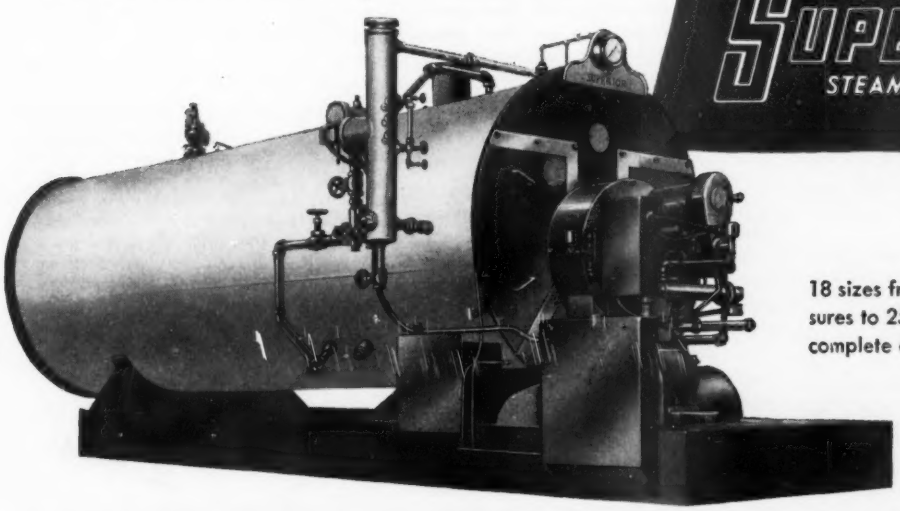
Superior Burners burn oil or gas or a combination of both... changing from one fuel to the other in seconds.

Superior Steam Generators are the ideal choice for a new steam plant... the simplest answer to expanding your present plant... the easiest solution to replacing obsolete boilers.

Guaranteed to develop maximum rated capacities at thermal efficiencies in excess of 80%, their design embodies features which insure long-lived dependability and maximum fuel economy.

for performance you can ***BANK*** *on*

SUPERIOR
STEAM GENERATORS



18 sizes from 20 to 600 b.h.p. for pressures to 250 p.s.i. or for hot water. For complete details write for Catalog 500.

SUPERIOR COMBUSTION INDUSTRIES INC. TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

George Edwards' Scrapbook

Had lunch with my friends at International Business Machines Corp in New York City yesterday while they unveiled their new "Electronic Brain". It's a production model of their newest and most powerful high-speed electronic calculator, the "701". Machine works any problem that a human being can—radiation effects in atomic energy; vibration and stress analysis; steam and gas turbine design calculations, etc.

Designing one modern fighting aircraft, for example, takes 900,000 man hours of calculations. The "brain" does it in 2 hours.

Any day now I'm waiting for the Russians to tell us that they invented this eighth wonder of the world back in Peter The Great's time.

* * *

"Let us endeavor so to live that when we come to die even the undertaker will be sorry"—Mark Twain

Old Mark sure had a way of saying things so people would get his point the first time.

* * *

I see in the British magazine "Oil Engine and Gas Turbine" that our English cousins sent a delegation here "to see whence comes that urge in American industrial undertakings to improve methods of manufacture."

Shucks, they didn't have to leave home for that information. Any of us Indiana Hoosiers could have told them when the little woman says she's not going to shift gears on the next family car; that she wants a vacuum cleaner with no messy dust bag to shake out; that her next automatic washing machine will be combined with a drying unit; that she wants a new all-electric kitchen put in; and then she adds that these items must be priced reasonably or she won't buy anything—well, our manufacturers either get that "urge" to please her or they eventually go out of business.

"Don't be afraid to stumble," said Charles F Kettering, General Motors Corp, many years ago. "If a chair is placed in the center of a large totally dark room, who will find it first? The person who philosophizes about where it is, or the person who starts stumbling about the room until he runs into it? Suppose you do fail 999 times, idea is to win the 1000th time."

No doubt that's why so many 'fools' succeed. They rush in where angels fear to tread.

* * *

Here's one I ran across while reading my old scrap book the other day; "No man lives without jostling and being jostled; in all ways he has to elbow himself through the world, giving and receiving offense."—Thomas Carlyle.

If Carlyle hadn't worked as a lineman for Tom Gurber when he wrote those lines, then he must have run into him somewhere, because I swear Tom was put on this earth to abuse me when I climbed poles for him in my apprenticeship days. And I guess I gave Tom a headache or two in exchange.

* * *

"If the buggy whip and the livery stable have become extinct," said Henry B du Pont, vice president of E I du Pont de Nemours & Co recently, "they cannot be mourned by a society that employs 12,000,000 people to make and service the automobile. Today, after the most intensive technological program in history, we have the largest employment force in history."

I'll have to show this to my brother-in-law next time he cries about those new impact tools down at the plant. He's afraid using them will throw some of the maintenance gang out of work—or something.

"Jack - of - all - trades is vanishing from the maintenance field," said D E Engle, maintenance manager of Firestone Tire & Rubber Co at the Plant Maintenance Show in Cleveland. "Reason is that highly specialized and automatic machinery takes specialized maintenance. That means maintenance costs go up while production costs go down. Solution is intensive training of maintenance manpower."

I suggest that firms interested to start training programs write to U.S. Dept of Labor, Bureau of Apprenticeship, Washington, D.C., and ask for (free) "The National Apprenticeship Program" booklet. There are 300 skilled occupations, listed under 90 trade classifications. Besides, this bureau has offices in principal cities with experts to help you start a training program. Also consult your local board of education.

* * *

"Unbelievable developments of the future in atomic energy were unveiled recently at Arco, Idaho," said F W Braun, v-p of Employers' Mutuals, at a conference. "Electricity was generated by atomic power, and at the same time created more atomic fuel than it burned up in the operation."

I'm glad that principle doesn't work with coal, or we'd have to send the ever increasing coal pile right back to John L.

* * *

"The young grad should not try to impress his fellow workers with the extent of his knowledge. The truth will leak out soon enough"—Phil Swain, from his New Proverbs For Young Engineers.

* * *

Always makes me feel good when I receive a letter on a business letterhead from someone I don't know and have never heard of, signed as Bill Smith, instead of W W Smith, for example. It makes the sender that much more alive and I always start my answer as Dear Bill: Fact is I get a little vexed when the letter doesn't tell me the sender's first name. Somehow that given name or nickname of Phil or Lou nails the sender down as a person I'd like to know and I remember his name that much better.

George Edwards

Engineer

CHEMICAL CLEANING PROVED MORE EFFECTIVE IN BOILER TEST

DOWELL method showed greater efficiency by 4.5% in utility company comparison

Perhaps the most convincing way of demonstrating the advantages of one method of cleaning over another is to conduct a comparative test.

That's exactly what one of the larger utility companies did to compare chemical cleaning with mechanical cleaning. The 23-day test was conducted with companion boilers, rated at 200,000 lb. per hour operating at 500 p.s.i. One boiler was chemically cleaned by Dowell, the other was turbined.

At the conclusion of the test, the boiler which was chemically cleaned by Dowell had a 4.5% greater efficiency factor with a saving of 0.1 lb. of coal for every pound consumed per KWH gross. With results like this to cite, it's no wonder leading plants in all parts of the country rely on Dowell service for their maintenance cleaning.

Dowell engineers do the job for you, using liquid solvents which are brought to your plant in truck-mounted tanks along with all necessary pumps and control equipment. No special scaffolding is required. Dismantling and down-time are kept to a minimum; equipment can often be cleaned while in operation.

For complete information and estimates on cleaning your equipment, call the nearest Dowell office, or write directly to Tulsa, Dept. E23.

DOWELL SERVICE

Over 100 Offices to Serve You with Chemical Cleaning for:

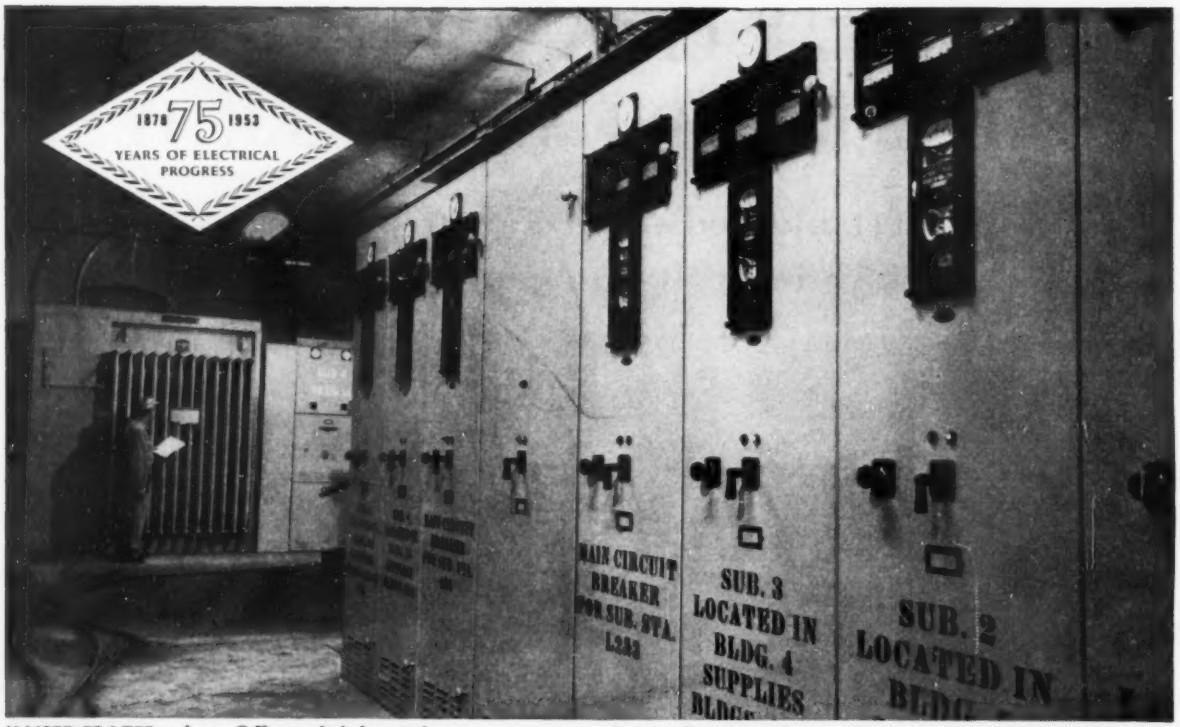
Boilers • Condensers • Heat Exchangers • Cooling Systems
Pipe Lines • Piping Systems • Gas Washers • Process Towers
Process Equipment • Evaporators • Filter Beds • Tanks

Chemical Services for Oil, Gas and Water Wells

DOWELL INCORPORATED · TULSA 1, OKLAHOMA

DOWELL

A Service Subsidiary of
THE DOW CHEMICAL COMPANY



KAISER-FRAZER selects G-E metal-clad switchgear to power modernized parts plant. Increased safety, protection against power shut-downs are provided by this 8-compartment, 4.16-kv lineup. Switchgear has two incoming line sections, tie breaker, five feeders—each feeding a 1000-kva load center, such as Substation No. 4 in background.

Kaiser-Frazer installs one of the most

EASILY installed armored cable, in center, replaces maze of old low-voltage cables at right—saves tons of copper.

TOOL ROOM shows interlocked armor cable leading to junction box, Trumbull Flex-A-Power* bus duct with plug-in connections.

FOR SWITCHGEAR CONNECTIONS, 700 feet of interlocked armor cable were pulled into position in 45 minutes. Cable can go under, over pipes, rafters, beams.

G-E UNIT SUBSTATION, one of five 1000-kva Pyranol* 4160-480Y/277 load centers in Kaiser-Frazer plant, powers nearby machines. Rail protects substation from battering of trucks.

modern plant power systems in America

New G-E metal-clad switchgear and radial load-center distribution system replace obsolete low-voltage system

In modernizing a factory in Dowagiac, Mich., for use as a parts plant, Kaiser-Frazer Company turned to General Electric for a complete electrical job.

A very important phase was the G-E engineered distribution system, installed by Koontz-Wagner Electric Company, Inc., of South Bend. This system features new, standardized metal-clad switchgear . . . replaces dangerous, inadequate equipment inside and outside the factory.

Two 3000-kva transformers, equipped with load ratio control, feed metal-clad switchgear through flexible interlocked armor cable. The compact, safe, metal-clad lineup, rated at 4.16-kv, in turn feeds five 1000-kva load centers in a reliable radial distribution system. High-voltage fluorescent lighting considerably reduces equipment costs. Neutral grounding increases system reliability and economy.

Kaiser-Frazer, with pre-assembled G-E equipment, has saved months of time, cut installation and maintenance costs, provided greater safety, and made the best possible use of plant space.

For information to help in your modernization plans, contact your local G-E sales representative—or write direct to General Electric Company, Schenectady 5, N. Y. 574-1

*Reg. Trademark of General Electric Company.

TWO TRANSFORMERS, 3000-kva, 27-4.16-kv with load ratio control, are installed by contractor.

GENERAL ELECTRIC

CYCLOTHERM* CYCLONIC COMBUSTION PRODUCES MORE STEAM... IN LESS SPACE... AT LOWER COST!

● In multiple installations or as a single unit, a Cyclotherm steam generator is your assurance of quick, dependable steam—plus greater all-round economy.

● You get more power . . . Cyclotherm Cyclonic Combustion flame control required just 3 sq. ft. of heating space per Boiler Horsepower. This means your Cyclotherm delivers 66% *more* steam generating power per sq. ft. than ordinary steam generators of comparable size.

● Cyclotherm steam generators can be conveniently located in any building where steam is required. With only 3 sq. ft. per Boiler Horsepower your Cyclotherm *saves* up to ⅓ the space of conventional steam generators. Installation is easier because each Cyclotherm arrives complete . . . connect fuel, electricity, water and a simple flue and it's ready to generate steam. Controls are fully automatic.

● A guaranteed *minimum* efficiency of 80% saves on fuel—gas, oil or combination—and lowers maintenance costs. Cyclotherm gives you full power from a cold start in 15 to 20 minutes. In multiple installations, an automatic battery control panel distributes the load for maximum operating economy.

● Cyclotherm steam generators are designed for 18 to 500 h.p., 15 to 200 psi operating pressures. Approved —ASME, National Board Standard, and Underwriters Laboratories, Inc.

*Reg. trade name

Find out how Cyclotherm Cyclonic Combustion will fill your steam requirements. Write for a free illustrated folder. Dept. 24

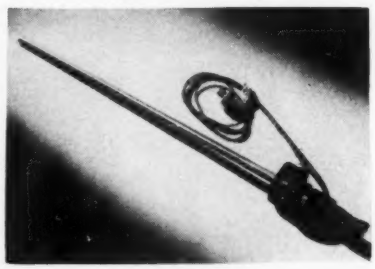
CYCLOTHERM* STEAM GENERATORS

More EQUIPMENT NEWS

Begins on page 160

sure, and liquid level to recording, indicating, and controlling receivers. Series 650 pneumatic transmitter uses standard measuring elements and a simple transmitting mechanism with only one pivot and no flexures. Unit is sensitive to extremely small changes in the measured value, as little as 0.03% of range, including reversal. Pneumatic relay has output capacity of 3.0 cfm. Unit weighs 7½ lb, can be installed in any location and will operate in any position.

Bristol Co, Sales Promotion Dept, Waterbury 20, Conn.



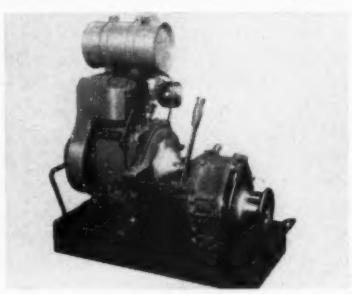
Bolt Heater

510 • Greater bolt stressing is possible in large hollow holding bolts, it is claimed, through use of new Corox bolt heater. As heated bolt cools in place, flanges are drawn together to make leak-proof joints.

Heater is supplied in ratings ranging from 1000 to 6200 watts at 120 v. Various sizes of heater elements permit installation in bolts 1 to 3 ft long and hole diameters from ½ to 1 in. With proper selection of power rating and size, heater life will average 500 hours.

Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

For more data on these items, use post cards p 169. Identify your request with item number.



Portable Winch

544 • *Stampco Gypsiwinch* is a lightweight portable electric or gasoline powered winch with a capstan-type drum for critical control of loads. Electric or gasoline motors range from ¾ to 7½ hp. Two handles facilitate moving unit from job to job while steel base is secured by ½-in. lag bolts. Unit also available with cable drum.

Anthony Machine Products Co, Dept KP, 2424 E Franklin Ave, Minneapolis 6, Minn.

(*Continued on page* 180)

MIDGETS...or

MAMMOTHS!

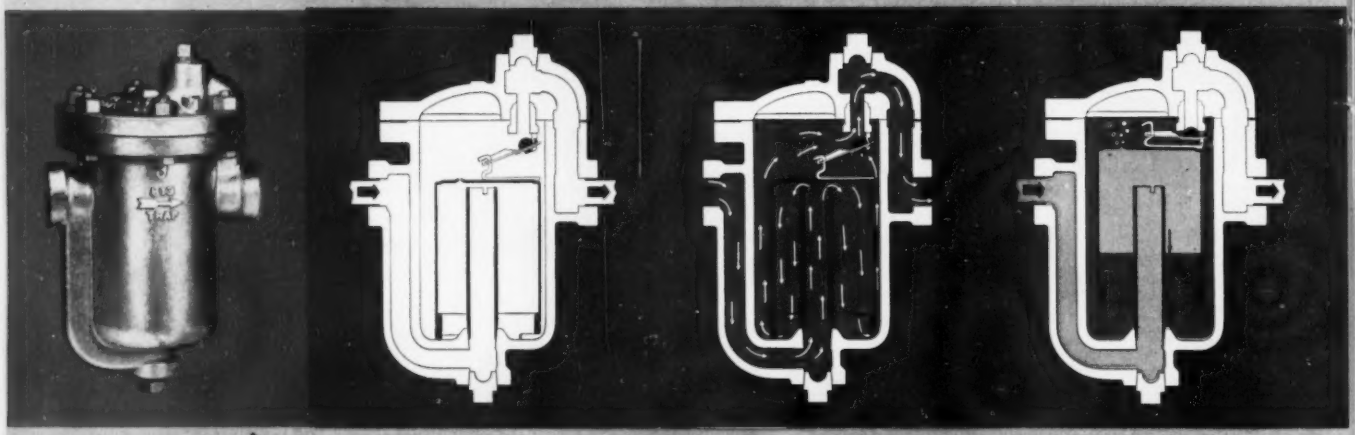
CHAPMAN makes STEEL VALVES for every job

For high-pressure, high-temperature service (as well as sub-zero duty), Chapman makes steel valves in a range of series from 150 to 2500 lb . . . in gate, globe, angle and check types . . . in steels of many different analyses and with suitable trim to resist corrosion and erosion.

Chapman Steel Valves are accurately machined and finished, designed to ASA and API ratings, and may be furnished with flanged or welding ends. These valves can be equipped for any type of operation . . . hand, gearing, hydraulic cylinder or Chapman motor unit as shown in illustration. So for all standard and any special Steel Valves, check with Chapman *first*. Meanwhile, write for Catalog 20.

THE CHAPMAN VALVE MANUFACTURING COMPANY
INDIAN ORCHARD, MASSACHUSETTS

ARMSTRONG TRAPS are



A WORKING PICTURE OF ARMSTRONG DESIGN

1. When trap is first installed, the inverted bucket is down and the valve is wide open.

2. When steam is turned on, condensate (solid color) flows into trap and out through discharge orifice, until . . .

3. steam (light color) reaching the trap floats the inverted bucket and closes the valve.

THE highly efficient design of modern Armstrong traps directly reflects over 40 years' experience in inverted bucket trap manufacture and application gained since Armstrong developed the first practical inverted bucket trap in 1911.

Armstrong design offers:

- A "frictionless" leverage system which combines high leverage with wide opening of a large orifice.
- A minimum of parts.
- Strong, corrosion-resistant and wear-resistant materials.
- Generous margins of safety.

For trap users this means:

- Large capacity.
- Dependable service under adverse operating conditions.
- Low maintenance.
- Continuous operation of heating and process equipment.

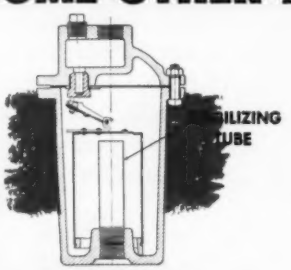
The soundness and benefits of Armstrong design have been proved in thousands and thousands of plants all over the world. To insure dependable condensate drainage for a new plant or plant expansion, simply specify: "Traps shall be Armstrong." For additional information, call your local Armstrong Representative or write:

ARMSTRONG MACHINE WORKS
812 Maple St., Three Rivers, Michigan

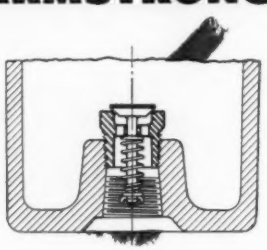
SELF-SCRUBBING ACTION (see Fig. 2 above). Note that condensate first flows down *between bottom of bucket and trap body*, then up and out through orifice. The high velocity flow under bottom of bucket keeps dirt in suspension, washes it out when trap opens. No dirt problems with Armstrong design.

BUCKET FLOATS WHEN LESS THAN ⅔ FULL OF STEAM (see Fig. 3 above). The generous margin of safety (dimension A in Fig. 3 above) insures that the bucket will float with trap body partly full of water. A heavier bucket would give more power but it might not float and close the valve.

SOME OTHER ARMSTRONG



STABILIZING TUBE
Condensate, air and steam are admitted above water level in trap bucket. The water level is undisturbed, eliminating wear-producing agitation of the bucket, valve lever and valve. This exclusive feature greatly lengthens life of working parts.

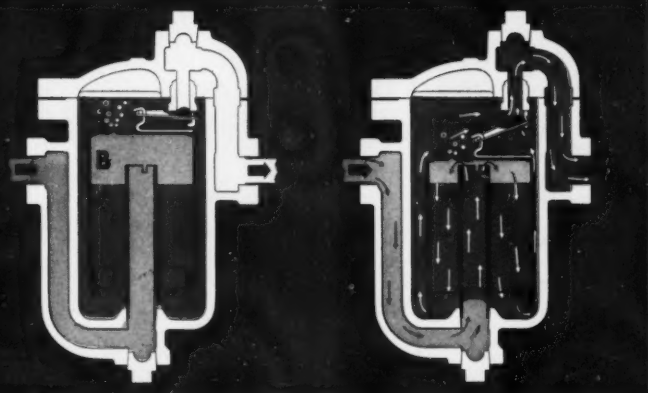


INTERNAL CHECK VALVE
All Armstrong traps can be equipped with the Armstrong spring-loaded stainless steel check valve. Costing less than an external check valve, it also saves installation labor and fittings.

ARMSTRONG "INVERTED BUCKET" STEAM TRAP

ARMSTRONG

Designed to give be[illegible]er Performance!

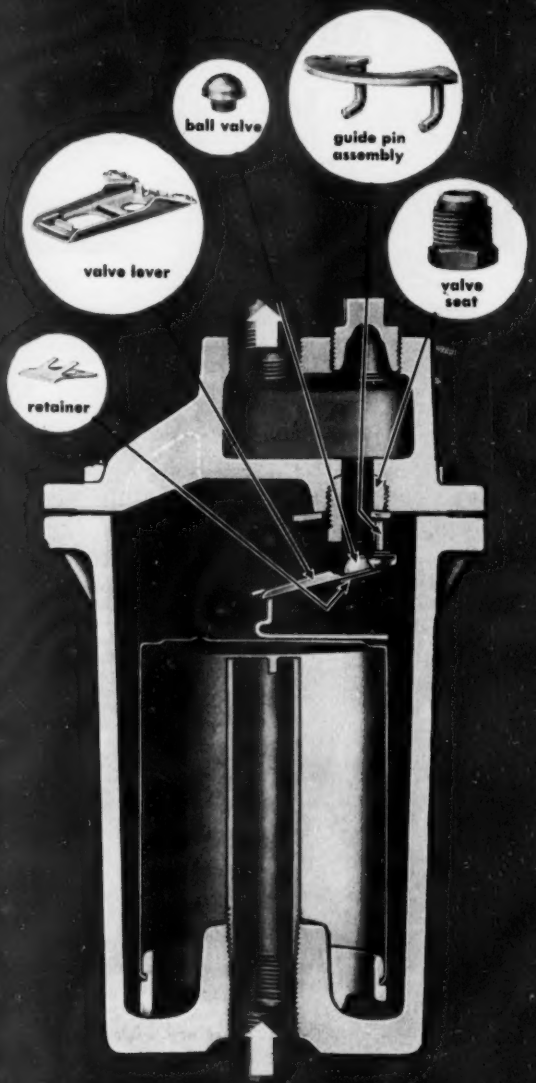


4. When more condensate enters the trap, the bucket loses buoyancy and pulls on valve lever.

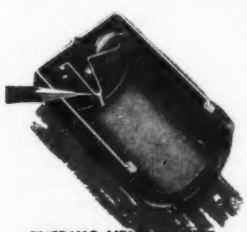
5. When weight of bucket times leverage overcomes pressure on valve, bucket sinks and opens trap.

NO AIR BINDING (see Fig. 4 above). Air mixed with steam passes through the bucket vent, collects at top of trap and is discharged ahead of condensate. The large air-handling capacity of Armstrong traps insures top equipment temperatures and faster heat-up.

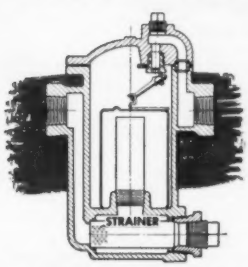
EXCESS POWER PROVIDED FOR OPENING TRAP (see Fig. 5 above). Weight of bucket times leverage opens trap. Here again Armstrong design provides a generous safety margin. Reducing dimension B in Fig. 4 would increase power of bucket but margin between test opening pressure and operating pressure would be too low to allow for normal wear and for pressure fluctuations.



TRAP DESIGN FEATURES



THERMIC VENT BUCKET
Where large amounts of air must be discharged when steam is turned on, and where air can be pushed out ahead of incoming steam, this bucket will speed heat-up greatly. The vent is open when trap is cold, closes at 210° F. Has 50 to 100 times air handling capacity of standard buckets.



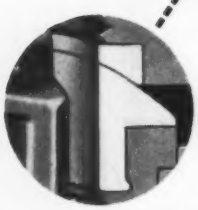
INTEGRAL STRAINER TRAPS
The two smallest sizes of Armstrong traps, most apt to need strainer protection, are available in a body style having the strainer built right in. The strainer can be cleaned while trap is operating.

SEND FOR *NEW*
44-PAGE STEAM TRAP BOOK

Complete data on Armstrong trap design and operation; physical data and list prices; capacities; selection, installation and maintenance recommendations. Free on request.

STEAM TRAPS

You'll SAVE Muscles and Money with Darts!



This True Ball Joint Makes the Difference

Dart seats are wider and spherically ground to a true ball joint. You get a *drop-tight* joint without excessive wrenching. Yes, and you can use Darts over and over again to cut your costs!

QUICK FACTS

- 2 BRONZE SEATS resist pitting and corrosion — stay serviceable year after year
- HEAVY SHOULDERS built to take severe wrenching
- NUT AND BODY of practically indestructible, air-refined, high test malleable iron
- THREADS full, clean-cut and hard. They won't deform or strip

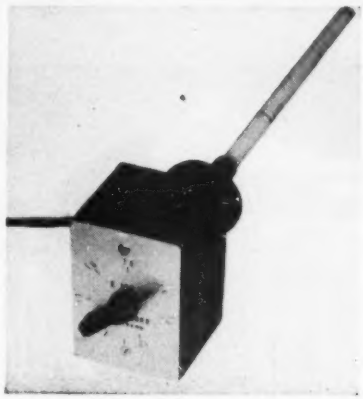
Be sure to say "Darts" to your supplier. They'll save you money and maintenance headaches over the years.

DART UNION COMPANY
Providence 5, Rhode Island
The Fairbanks Co. — Distributors
Boston • New York • Pittsburgh • Rome, Ga.

DART
UNIONS

More EQUIPMENT NEWS

Begins on page 160



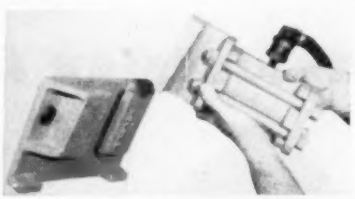
High-Temperature Thermostat

515 • *Temp-Gard* is a low-cost mechanically operated thermostat for temperatures from 600 to 2000 F. Unit works when Inconel rod expands and contracts in relation to surrounding porcelain tube, operating a microswitch. Control switch is rated 12 amps, and 125, 250 or 400 v, ac. For higher current or dc, the control operates remote solenoid switch. Unit can be arranged for a manually set, optional temperature holding or shut-off. Holding temperature fluctuates from 3 to 4%, depending on setting.

Calibrations available include 600-1200, 1200-1800, and 1400-2000 F. Maker states that the Inconel rod resists high temperature steam and mixtures of steam, air and carbon dioxide. It also resists attack by carburizing environments.

Maintenance is slight, replacements or adjustments are easy to make, and thermostat is not affected by voltage fluctuations. or vibration, manufacturer claims.

Kiln-Gard, 38 Normandy Rd, White Plains, N. Y.



Air Vibrator

524 • New 2 in. piston diameter LSRR air vibrator is easily portable. Cast steel male bracket fits snugly into female bracket, steps up unloading of materials with a tendency to pack down. Unit starts and stops instantaneously, is ideal for applications where one vibrator can serve several bins.

Cleveland Vibrator Co, 2828 Clinton Ave, Cleveland, Ohio.

For more data on these items, use post cards p 169. Identify your request with item number.

Centrifugal Pumps

547 • Each of three new models, VBH, VD and VE, is available in sizes from 1/20 to 5 hp, with several different port styles and mounting brackets. Larger sizes rated

MACHINE MILESTONES... MEASURED IN OIL! The impressive record of petroleum "firsts" listed above spans 87 years of industry's most spectacular progress. From the first mineral oils for machines in 1866 to the first oils for Diesel engines, cars, planes—right on up to correct lubrication for the world's fastest superliner—Socony-Vacuum has pioneered the development of the products that have helped make these advances possible. Today, this wealth of lubrication knowledge and experience is yours—to help boost your output, cut your maintenance costs. Why accept anything less?

SOCONY-VACUUM
Correct Lubrication

SOCONY-VACUUM OIL COMPANY, INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY, GENERAL PETROLEUM CORPORATION

valve values
PHOTO NEWS

Radioactivity, Magnetism Assure Edward Valve Soundness

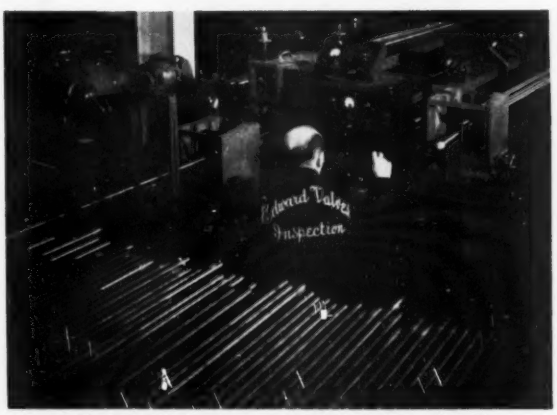
The technician above is using Cobalt-60, a radioactive isotope obtained from U. S. and Canadian Atomic Energy Commissions in the radiographic examination of an Edward Fig. 4006Y cast steel valve. Using gamma-rays, the radiographic technique gives photographic evidence of the internal structure of metals, instantly reveals internal voids or weaknesses not capable of detection by any other method.

Radiographic inspection is an old story at Edward. In use since 1928, Edward has built up a file of over 203,000 radiographic negatives attesting to the soundness of valves already in service. And the backlog of experience gained in applying and interpreting radiographic methods over the years assures Edward customers of the greatest possible measure of protection from this technique.

Radiography is only one of many methods, some old, some new, used in thoroughly inspecting all materials that make up Edward Valves. A new testing procedure is illustrated at right—a magnetic-electronic device which tests bar stock entering the Edward plant, assuring 100% soundness and uniformity in the materials used for stems, studs, and other vital valve components. By measuring variations in electrical and magnetic characteristics, this unit reveals any deviations in hardness, chemical analysis, or grade, and any internal cracks or structural differences. It can even tell whether two bars came from the same or different "heats."

Inspection procedures like these illustrate the determination at Edward to quickly adopt every modern technological development which permits further verification of the superiority of our materials, manufacturing methods or designs. These continual checks have helped to build the reputation for dependability in service which is our most valuable asset—and one which we are determined to protect at all costs.

Over 203,000 radiographic negatives on valves now in service are filed for reference. Skilled technicians, qualified by long experience, examine minutely all negatives proving material soundness of Edward Valves.



Magnetic-Electronic device checks every inch of bar to left of operator above, detects all cracks or voids, differences in hardness, chemical composition or internal structure.

Edward Valves, Inc.

Another Product

HOW TO CUT MAINTENANCE COSTS *by Proper Valve Packing*

Perhaps the greatest single item of valve maintenance today is the adjustment or replacement of packing. In good, modern valve designs other potential causes of maintenance have been largely eliminated, leaving packing as the major regular maintenance item required. Following these simple rules will allow the plant operator to drastically cut the time spent on packing maintenance:

1. PACKING SHOULD FIT PERFECTLY. Too much packing makes valve operation difficult; too little packing soon results in leakage.

An experienced man working carefully with coil packing can get proper fit in a good percentage of cases. However, the use of preformed packing, die cut to exactly fit the packing chamber, insures a perfect fit in all cases, and at a fraction of the time and trouble.

2. TWO DIFFERENT TYPES OF PACKING ARE BETTER THAN ONE. Packing in a valve chamber is subjected to two opposing requirements. First, it must be soft enough to be squeezed tightly against the valve stem and packing chamber for a perfect seal. Second, it must not be so soft that it is extruded from the ends of the packing chamber when line or gland pressure is applied.

A combination of two different types of packing rings best meets these opposing requirements. The outer rings adjacent to junk ring and gland should be reinforced for additional stiffness, while the center rings should be of a softer variety for maximum sealing effect.

3. PACKINGS SHOULD BE LUBRICATED. For easier valve operation, packing materials should have a built-in lubricant—generally Graphite or Mica. Of these two, graphite is much more satisfactory in providing easier valve operation.

4. WATCH STEM PITTING. Packing should be specially treated to eliminate electrolytic corrosion of stainless steel valve stems. In addition, if valves are to be subjected to hydrostatic tests or will be stored for a long period before installation, the packing should be waterproofed to prevent absorption of moisture and subsequent corrosion, or packing deterioration.

5. CHECK DESIGN OF VALVE. Valve design plays a very important part in determining packing life. Designs which provide an effective backseat, and remove the packing from high temperature zones stretch packing life. Correct proportions in the packing chamber are also important—avoid designs that call for extremely wide packing rings, since these tend to reduce packing life.

Operators can avoid packing problems by following one rule which insures compliance with all those listed above—to use Edward EValpack packing in Edward valves. This specially designed packing is furnished in sets designed for each specific Edward valve. Every set consists of two different types. The center rings are die moulded plastic composed of long fibre asbestos lubricated with graphite. The outer rings have the same general composition with, for additional stiffness, a woven jacket of asbestos strands reinforced by metal wires. All sets are specially treated to eliminate stem pitting and waterproofed to eliminate corrosion. They can be installed in a minimum of time and will provide the longest possible service life.

Write for Bulletin 12-R for complete information.

EDWARD VALVES, Inc., *Subsidiary of*
ROCKWELL MANUFACTURING COMPANY
1220 W. 144th STREET • EAST CHICAGO, INDIANA

GLOBE AND ANGLE STOP • FEED-LINE • BLOW-OFF • NON-RETURN CHECK • GATE • GAGE AND INSTRUMENT • RELIEF • STRAINERS

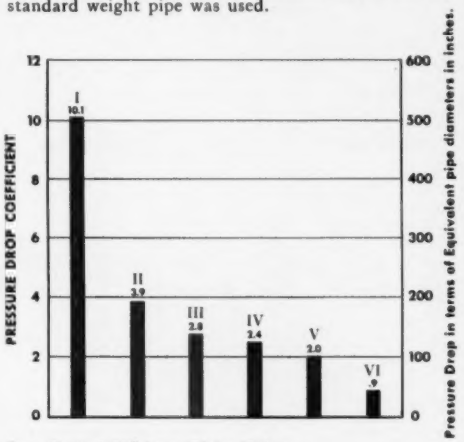
COPYRIGHT 1953, EDWARD VALVES, INC.

Technical Tips

Pressure Drop in Steel Valves 2 Inches and Smaller

In valves 2 in. and smaller, pressure drop is important for two principal reasons. First, obviously, from the standpoint of head loss—which may be unimportant in some instances, but have a serious economic significance in other applications. Second, pressure loss is due primarily to turbulence within the valve, which is also the principal cause of wear-producing vibration and erosion. Pressure loss in a valve therefore serves as a good index of its service life, other factors being equal.

The chart below, based on tests in the Edward laboratories, shows the pressure drop characteristics of various types of valves, with an elbow fitting included for purposes of comparison. These are given in terms of pressure drop coefficient and pressure drop in equivalent pipe diameters. In calculating these latter values the pressure drop coefficient of f=.02 for standard weight pipe was used.



I. Typical 90° Stem Globe Valve.
II. Inclined stem, screwed in seat globe valve. Edward Fig. 444, 448, 631.
III. Inclined stem, integral seat globe valve. Edward Fig. 2224, 931, 948.
IV. Typical small gate valve. Seat diameter 70 per cent of pipe diameter.
V. Angle stop valve. Edward Fig. 445, 449, 949.
VI. Elbow, screwed or socket welding end.

The user can readily calculate the equivalent length of pipe from the standpoint of pressure drop for certain small valve types with this chart. For example, a 1 in. inclined stem globe valve with integral seat will have a pressure drop equivalent to 120 in. or 10 ft. of 1 in. pipe, and the 2 in. size of the same valve will have a pressure drop equivalent to 240 in. or 20 ft. of 2 in. pipe.

The superiority of inclined stem construction for globe valves in this size range is obvious—note that the integral seat Y-type globe valve has a pressure loss 72% less than the 90° stem type globe valve. The pressure loss characteristics of Y-type globe valves compare quite favorably with gate valves. The tighter shut off obtained, ability to throttle and other advantages realized with these globe valves, make desirable their use in many applications.

Edward

CONSIDER
STEAM TURBINES
AS MOTIVE POWER

TO OPERATE
COMPRESSORS
PUMPS
FANS
BLOWERS
WINCHES
GENERATORS
MIXERS
AND
SIMILAR
EQUIPMENT

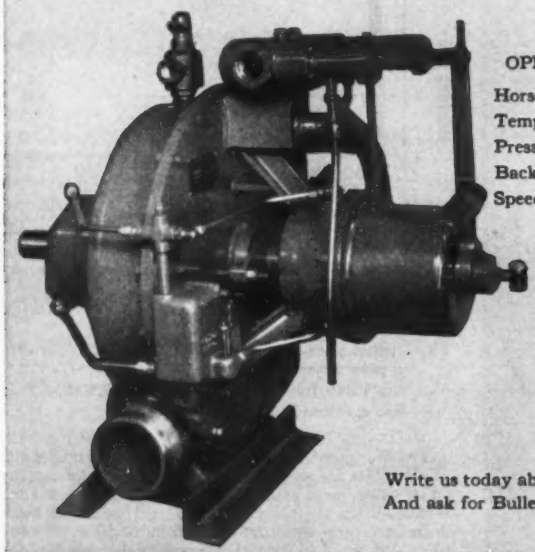
HERE ARE THE ADVANTAGES:

VERSATILE DEPENDABLE: Wing Steam Turbines give an infinite range of speeds, easily controlled by throttling. Always on the job, you are completely *independent* of any electric power failure.

ECONOMICAL: Wing Steam Turbines cost little or nothing to operate where their oil-free exhaust steam can be used in process operations—or in space heating. The Turbine acts as a reducing valve . . . its exhaust steam has been reduced down to the pressures used in heating and cooking operations.

NO SPARKS: Wing Steam Turbines are especially desirable for operations involving explosive gases and flammable materials, where sparks could be dangerous.

SMOOTH ACCELERATION OR DECELERATION: Wing Turbines can be smoothly accelerated or slowed down to meet the needs of the process, fan, pump or other driven apparatus.



OPERATING RANGES:

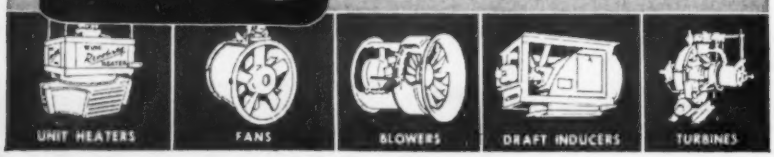
Horsepowers to	150 b.h.p.
Temperatures to	750°F.
Pressures to	600 p.s.i.
Back Pressures to	50 lb.
Speeds to	4000 r.p.m.

WING Steam Turbines have been serving industry for over a half-century. They are known for their rugged construction, trouble-free operation, and long life.

Write us today about further information. And ask for Bulletin SW-1a.

Wing

L. J. Wing Mfg. Co.
50 Vreeland Mills Road
Linden, New Jersey
Factories: Linden, N.J. and Montreal, Can.



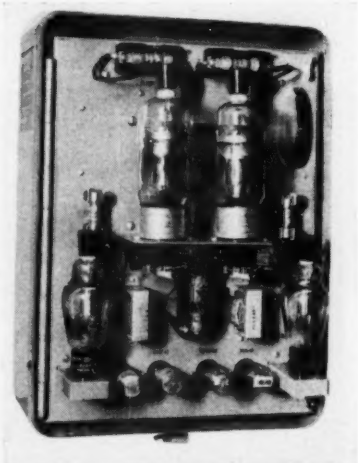
More EQUIPMENT NEWS

Begins on page 160

to 148 gpm at free flow and 9 gpm at 124.7 ft head. Pumps feature separately removable intake bracket and support column for simplified maintenance.

All models are seal-less and have no pump bearings, seals or other moving metal-to-metal parts, thus are suited to handle high solid and abrasive suspensions.

Pioneer Pump, Div of Detroit Harvester Co, 19657 John R St, Detroit 3, Mich.



Adjustable Speed Drive

542 • Simplified *Thy-mo-trol* packaged electronic adjustable-speed drive is available for ¾ to 3 hp drives. It offers stepless speed control, pre-set speed control and closed speed regulation, manufacturer claims, and includes the smallest GE *Thy-mo-trol* drive panel (photo, above).

Drive has standard speed ranges of 5:1 and 20:1, both reversing and non-reversing. Speed is selected by turning a single knob. Motor holds any speed within ± 3%. Simplified system consists of an anode transformer, electronic control panel, control station, and dc shunt-wound motor. Bulletin GEA-5829.

General Electric Co, Schenectady 5, N. Y.

For more data on these items, use post cards p 169. Identify your request with item number.

Flashing Bulletin Board

558 • Bulletin board operates on a 40-w lamp and flashing unit. Flashes approximately 15 times a minute. Carries two separate messages that may be read from a wide angle. Accommodates National Safety Council posters and other sheets up to 8½x11½ in. Construction allows for fast changing of posters.

Industrial Products Co, 2923 N Fourth St, Philadelphia 33, Pa.

Phosphor Bronze Electrode

559 • No. 24 type C phosphor bronze electrode is announced for arc brazing nickel alloys and cast and malleable iron; and for

For Silica-Free Water at Low Cost . . .

Deionize with AMBERLITE Ion Exchange Resins

AMBERLITE deionization eliminates evaporators, and still gives you highest-quality boiler feed water. Silica, carbon dioxide, and hardness are reduced virtually to zero. Total ionized solids can be kept consistently below 0.1 p.p.m. In addition . . .

1. The initial cost of your water-conditioning system is reduced.
2. Operating costs go down.
3. Maintenance costs you less.
4. You are sure of an adequate supply of conditioned water—despite variations in demand and in the quality of your raw water.
5. Your AMBERLITE unit requires much less space than evaporators.
6. You have a choice of multiple-bed or Monobed (mixed bed) systems.

AMBERLITE and Monobed *are trademarks, Reg. U.S. Pat. Off. and in principal foreign countries.*

For more information about AMBERLITE deionization, write Dept. P-2 for complete literature. For bi-monthly reports on new developments in ion exchange, ask to receive AMBER-HI-LITES.

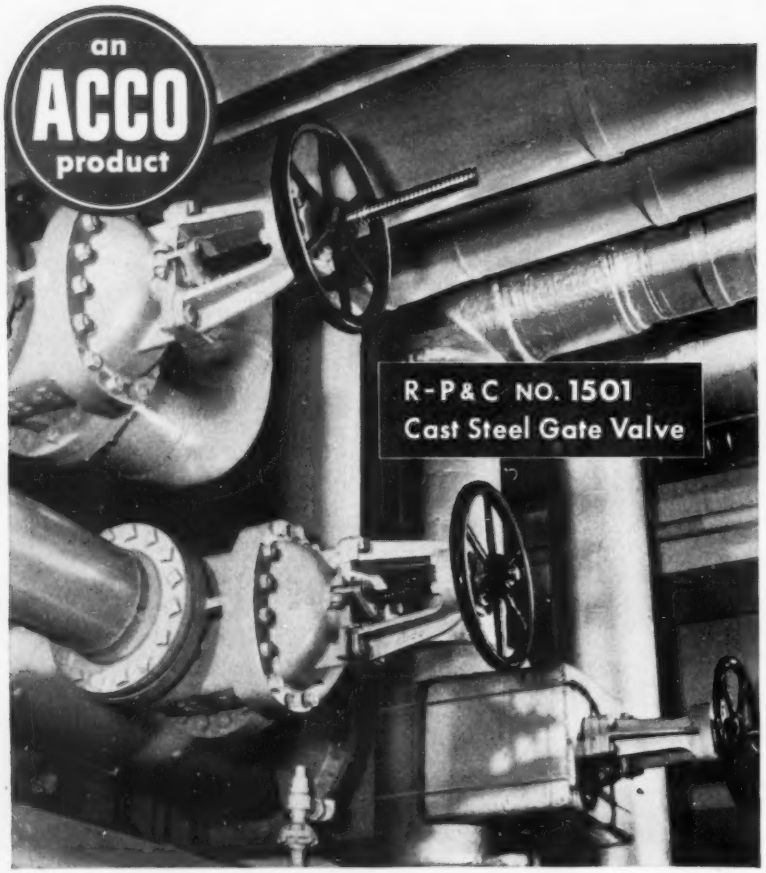
CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

THE RESINOUS PRODUCTS DIVISION

Washington Square, Philadelphia 5, Pa.

Representatives in principal foreign countries



How R-P&C Valves Reduce Maintenance Costs

• Six important features of R-P&C Cast Steel Valves eliminate many service troubles which in turn reduces maintenance costs.

First of all . . . they're made from electric furnace steel which means sound castings. All parts are designed for equal strength and great toughness. The bodies resist distortion. Permanent alignment is provided by the rigid one-piece yoke. And the gland packing stays tight even at high pressures and temperatures. Furthermore, the design detail assures smooth flow and positive shut-off.

You can get R-P&C Cast Steel Valves in gate, globe, angle, stop and check, and swing check types. Variety of trim metals for air, gas, liquid, oil, steam, water. Wide range of pressures and temperatures. Screwed, flanged, or welding ends. Sizes range from 1½" to 24".

Specify . . . and *get* . . . R-P&C Cast Steel Valves next time you order.

ACCO

R-P&C VALVE DIVISION
AMERICAN CHAIN & CABLE

Reading, Pa., Atlanta, Baltimore, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

TRADE MARK

R-P&C valves

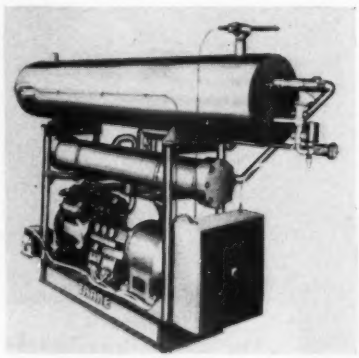
More EQUIPMENT NEWS

Begins on page 160

arc welding copper, bronze and brass.

Special flux is said to completely encircle each drop of metal as it leaves the electrode and to provide "globular protection" until it is deposited on the base metal. Deposit maintains even the tin in original analysis. Slag or impurities float out in a form that is easily removable, manufacturer claims. Deposition rate is high at all current settings, with minimum of splatter and maximum appearance and physical properties. Reverse polarity d.c. current only is used. Available in six standard sizes from 3/32 up to and including ¼ in.

All-State Welding Alloys Co, Inc, White Plains, N. Y.

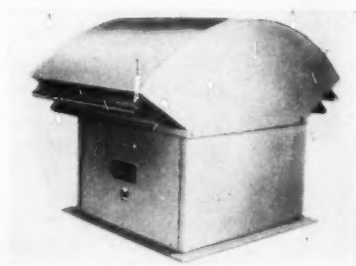


Packaged Water Chiller

560 • Cold generator provides a single-unit source of large quantities of cold water for air conditioning and refrigeration systems requiring between 10 and 50 tons of cooling. Self-contained unit requires only simple water and electrical connections and eliminates complex installation and maintenance problems. Compressor, condenser, liquid cooler, controls, motor and accessories are combined in a single factory-assembled and tested unit. Power and water consumption is automatically adjusted to the demand for cooling. Unit will be made in six sizes, with capacities from 10 to 50 tons of refrigeration.

Trane Co, La Crosse, Wis.

For more data on these items, use post cards p 169. Identify your request with item number.

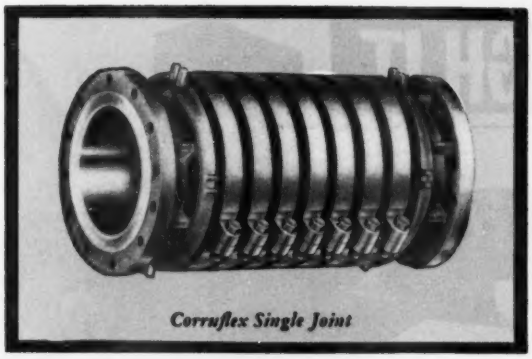


Roof Ventilator

532 • Heavy-duty, high-velocity roof ventilator is especially well adapted for windowless plant construction. Primarily used as exhaust fan, it can easily be adapted for fresh air supply. Sizes 12 to 48 in,

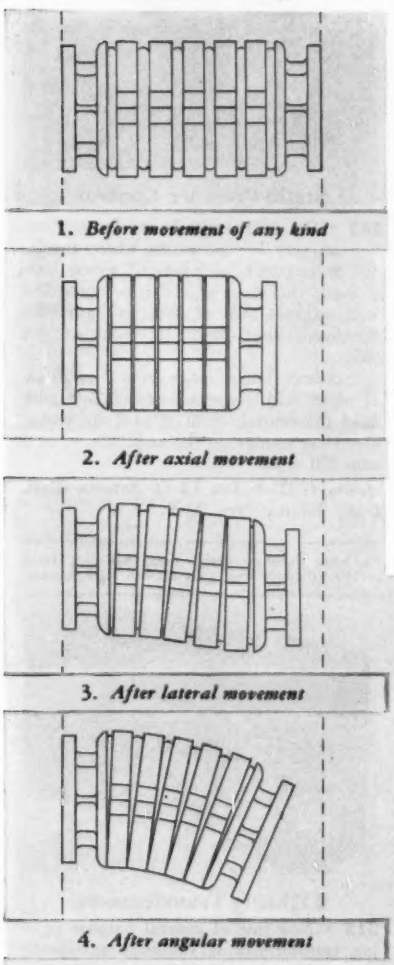
INSTALL...

AND THEN FORGET



Corruflex Single Joint

Corruflex PACKLESS EXPANSION JOINTS



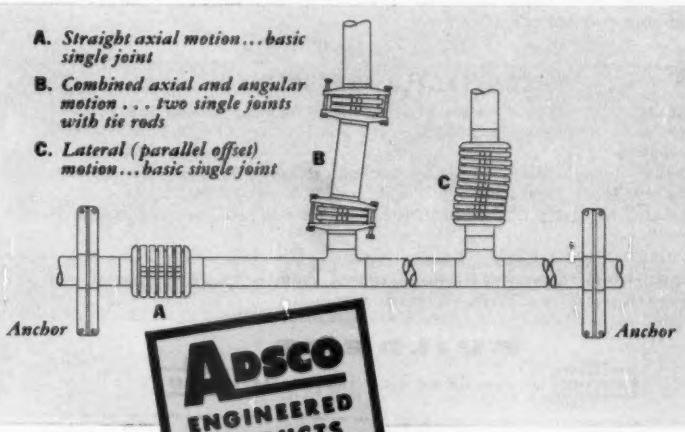
1. *Before movement of any kind*
2. *After axial movement*
3. *After lateral movement*
4. *After angular movement*

Why worry about maintenance in pipe lines when you don't have to? Install ADSCO Corruflex Expansion Joints... they are packless and require no maintenance. Put 'em in the line and forget 'em.

In ADSCO's *complete* Corruflex line there are many joints for many purposes: Swing, Hinge, Tie-Rod, Universal, Internally-Guided, Anti-Compression, Balanced, Gimbal, etc. But the leader of the Corruflex line...the joint from which all others are derived...is the Basic Single Joint shown on this page. Here is a dependable workhorse which will solve many pipe expansion problems. Problems *it* can't solve *can* be solved by other Corruflex Joints.

Drawings 1 & 2 at left show accordion-like movement as the Basic Single Joint opens and closes to absorb axial movement. In Drawings 3 & 4, note that maximum lateral deflection and maximum angular rotation are obtained when joint is in median position. ADSCO can supply complete tabular data on the maximum amount of allowable lateral and angular movement either side of center line. Under certain conditions, such as the addition of extra corrugations, the Basic Single Joint can be used to absorb combined axial and lateral or combined axial and angular motions.

For assistance in laying out piping systems, a cordial invitation is extended to you to consult ADSCO's engineering staff. Phone your ADSCO representative about this service or write the factory direct.


A. Straight axial motion... basic single joint
B. Combined axial and angular motion ... two single joints with tie rods
C. Lateral (parallel offset) motion... basic single joint
B
C
Anchor
A
Anchor

ADSCO ENGINEERED PRODUCTS

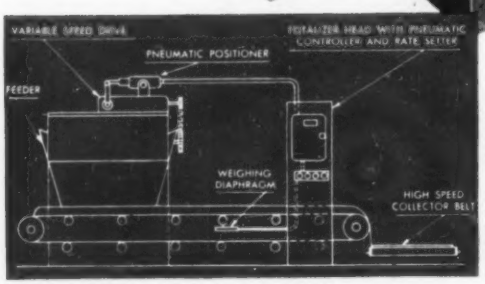
EXPANSION JOINTS • HEAT EXCHANGERS • STEAM TRAPS • STRAINERS • SEPARATORS • METERS

AMERICAN DISTRICT STEAM COMPANY, INC.

NORTH TONAWANDA, NEW YORK

Since 1877

WEIGH IT ...on the Go



Typical Conveyoflo installation showing Model CFAB-T Conveyoflo Meter controlling flow of tobacco in automatic blending process. Conveyoflo employs pneumatic controller to automatically control feeder output within very narrow tolerances.

Conveyoflo Meters are serving in many other process industries: food, soap, fertilizer, pharmaceutical, steel, paper, glass, heavy chemicals, mining, power. *What's your processing problem?*

Weigh it with BUILDERS CONVEYOFLO . . . the modern meter for *continuous, accurate weighing* of bulk material passing over conveyor belts. This precision meter can be equipped with a Controller to maintain any desired preset rate of delivery from the conveyor in which it is installed. Or it can be used to pace auxiliary feeders in automatic processing systems. Conveyoflo is furnished as a separate, self-contained unit — or for installation in your present conveyor lines.

CONVEYOFLO FEATURES

- ACCURATE . . . within ± ½ of 1% of actual weight from maximum to 50% of rated capacity; within 1% from 50% to 25% rate; within 2% from 25% to 10% of meter's rated capacity.
- COMPACT . . . weight sensing mechanism completely contained within conveyor structure. No overhead levers. Panel stand only 9" x 18" — may be any height.
- AUTOMATIC TOTALIZER COMPENSATION for variations in belt speed and changes in belt weight.
- RESPONDS ACCURATELY to rapid load variations.
- PACES AUXILIARY EQUIPMENT (feeders, controllers, continuous blending processes, etc.) and operates secondary totalizers, indicators, recorders.

BUILDERS

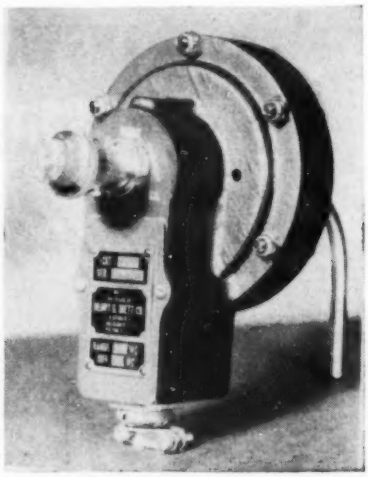
BIF INDUSTRIES (DIVISION OF B-I-F INDUSTRIES) BUILDERS

BUILDERS-PROVIDENCE, INC.
354 Harris Ave., Providence 1, R. I.
Please send Bulletin 550-H4 describing Builders Conveyoflo Meter.
Name.....
Company.....
Street.....
City..... *State*.....

More EQUIPMENT NEWS

Begins on page 160

1300 to 20,000 cfm free air, 860 to 14,500 cfm at ½ in. static pressure. Bulletin 511. **Chelsea Fan & Blower Co, Inc, 639 South Ave, Plainfield, N. J.**



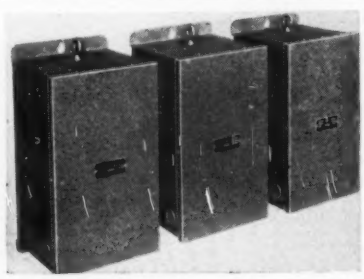
Static Pressure Control

561 • Cat 101P controls are for application on very low pressures where regulation is required in inches of water. Unit is used where circuit must be controlled, from exhaust side of fan, and auxiliary equipment shut down in event of fan failure.

Standard ratings range from 0 to 20 in. of water, with range adjustment and with fixed differentials from .2 to 2 in. water. Electrical ratings are 10 amp, 125, v, or 5 amp 250 v, ac.

Henry G Dietz Co, 12-16 Astoria Blvd, Long Island City 2, N. Y.

For more data on these items, use post cards p. 169. Identify your request with item number.



Lighting Transformers

513 • New line of general purpose lighting transformers is designed specifically for quicker, easier installation indoors and outdoors. Designated Type C, units are available in sizes from 1 to 15 kva, single and three phase, to 600 v, with class B insulation.

Marcus Transformer Co, Hillside, N. J.

Container Markers

562 • *Quik-label* container markers stick fast to glass, metal, wood, plastic or ceramic

curious?

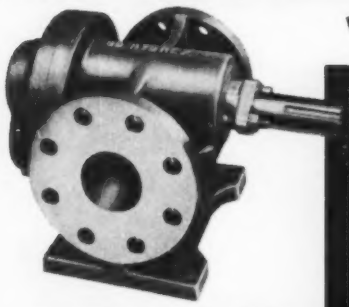
Furnace Operators! A little curiosity about this amazing FREE service can pay big dividends. *It's the Cities Service Heat Prover*. . . "not an instrument you buy, but a service we supply!" This unique instrument offers rapid, continuous sampling . . . simultaneous reading and direct measurement of oxygen and combustibles . . . and easy portability. We maintain the Heat Prover free of charge! It's not a curious fact that so many furnace operations have been bettered with the Heat Prover. Find out how and why the Heat Prover can increase furnace productivity for you. Call or write your nearest Cities Service Office or write Cities Service Oil Company, Dept. E16, Sixty Wall Tower, New York City 5, N.Y.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

SIMPLICITY CUTS COSTS

when you buy and use the



New Sier-Bath "Hydrex" PUMPS

For pumping fluids and semi-fluids, 32 SSU to 250,000 SSU. Capacities 1-500 GPM; 300 PSI for continuous duty, 500 PSI for intermittent service.

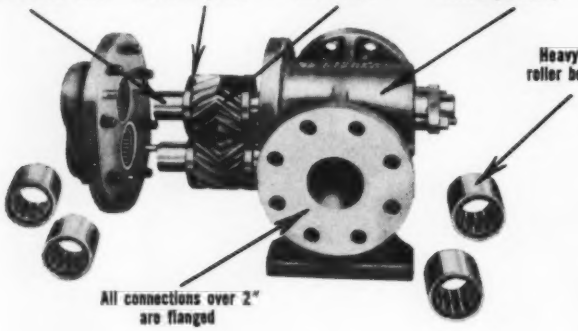
Shafts hardened and ground at bearings. No inner races required.

Easily replaceable side wear plates

Precision manufactured rotors

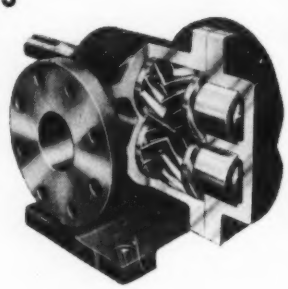
Only one stuffing box (under suction pressure)

Heavy duty roller bearings

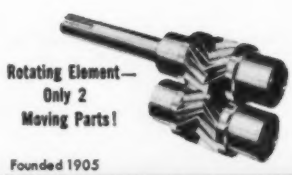


All connections over 2" are flanged

New Simplified Design Allows High Quality at Low Cost



- Hydraulically balanced axially
- Shaft hardened and ground at stuffing box. Minimizes wear.
- Easy to assemble, disassemble—cuts maintenance costs.
- All machined surfaces ground for easier piping, aligning
- Short, large diameter shafts
- Horizontal or vertical construction



Rotating Element—Only 2 Moving Parts!

Founded 1905 Member A.G.M.A.

Sier-Bath GEAR and PUMP CO., Inc.

9257 Hudson Blvd., North Bergen, N. J.

Write for "Hydrex Pump Reply Sheet." Reverse side can be filled in for prompt quotation.

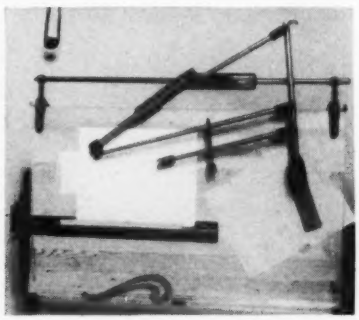
Sier-Bath Screw and "Gearex" Pumps for higher capacities and pressures . . . also mfrs. of Precision Gears and Flexible Gear Couplings.

More EQUIPMENT NEWS

Begins on page 160

containers without moistening. They are made of cotton cloth, and are silicone plastic-coated to resist oil, grease, grime and abrasion. Label surface is unaffected by most of the materials container may hold. Markers are printed with warning words and precautionary instructions, have a space for a self-sticking insert with name of the hazardous material.

W H Brady Co, 727 W Glendale Ave, Milwaukee 12, Wis.



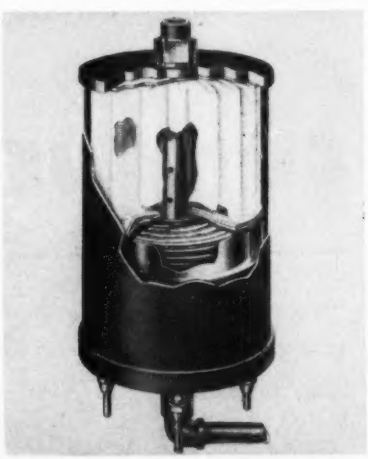
Drafting Machine

517 • *Vibax* drafting machine automatically produces isometric and dimetric views by tracing over the lines of standard orthographic drawings. Manufacturer claims that ellipses will be perfect and lines will be at correct angles and to same scale as original drawing.

Machine can be attached to any drafting board without interfering with existing drafting equipment. When not in use it simply hinges back off board. Bulletin V-14.

Vibroscope Co, 6 E 39th St, New York 16, N. Y.

For more data on these items, use post cards p 169. Identify your request with item number.



Air Dehydrator and Filter

563 • Dehydrating and filtering ordinary plant air in the new Model B-30-D Condensifilter is said to provide "instrument quality" air.

Filtering unit is made of wire mesh, with

A BRAIDED ASBESTOS PACKING

STYLE 804

To Withstand High Pressure Superheated Steam or Hot and Dry Gases

Stays Soft and Resilient

You will find many uses for this superior Anchor braided asbestos packing, which is available in ring, spiral and coil. It is known to industry as 804 packing.

Ankorite 804 is a pure asbestos graphite plastic core packing having an outer jacket of closely braided high quality asbestos yarn. The jacket is reinforced with monel metal wire.

As Ankorite 804 will stay soft against high pressure and high temperature conditions, it is the ideal packing against high pressure, superheated steam, or for hot and dry gases, as well as many other uses.

For further details on Ankorite 804, write us today.

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MONTREAL, CANADA
NEW ORLEANS, LA.
NEW YORK, N. Y.
PHILADELPHIA, PA.
PITTSBURGH, PA.
SAN FRANCISCO CAL.
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THE ANCHOR PACKING COMPANY

GENERAL OFFICES: PHILADELPHIA, PA.
FACTORIES: MANHEIM, PA. ELKHART, IND. MONTREAL, CAN.

FIBROUS AND METALLIC PACKINGS FOR EVERY INDUSTRIAL PURPOSE

Controlled Pressure

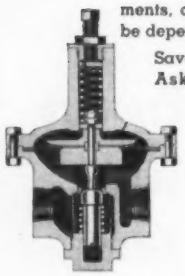
for efficient operation

Clark Pressure Reducing and Regulating Valves

are precision-made for positive pressure control on air, gas or steam lines.

Where different types of equipment, with varying pressure requirements, are operated from a common line, Clark Regulating Valves can be depended on to deliver automatically the "just right" pressure to each.

Save on fuel, maintenance and protect expensive equipment. Ask your Clark representative to specify the right Clark valves for your needs . . . or write us direct.

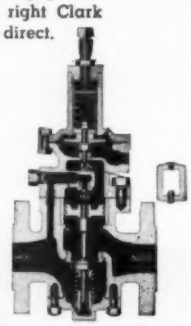


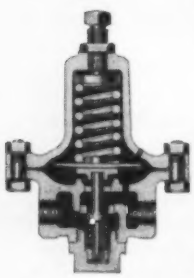
TYPE KRV

Pressure Reducing Valve. Diaphragm Operated-Single Seated Valve. Sizes ½" to 1½" for initial pressures up to 250 P.S.I. Reduced pressures to 85 P.S.I.

TYPE CRV

Pressure Reducing Valve. Integral pilot controlled, piston operated. For pressure control from "dead end" to full capacity. Sizes ½" to 6".





TYPE ORV

Pressure Reducing Valve. ⅜" and ½" Single Seated, Spring Loaded, Diaphragm Actuated. For initial pressures to 250 P.S.I. Reduced pressures to 200 P.S.I.

QUICK-CLEANING STRAINERS

Remove dirt, scale and grit from steam, fluid and gas lines. Sizes ½" to 3" I.P.S. For pressures to 250 P.S.I.

THE HOME OF DUO-STEP LEVERAGE

Clark

MANUFACTURING COMPANY

1830 EAST 38th STREET

CLEVELAND 14, OHIO

Distributors and Representatives in all major cities

More EQUIPMENT NEWS

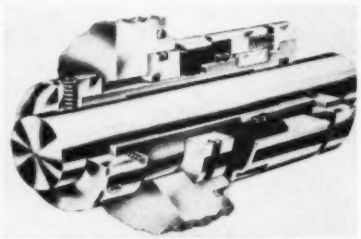
Begins on page 160

securely attached flannel. Cartridge has a radial fin design that provides 540 sq. in. of filtering area. When filter becomes dirty, entire cartridge can be quickly replaced.

Condensing unit has a 400 sq. in. surface area. Accumulated condensate is discharged through the trap valve, which has a float-operated, snap action.

Rated capacity of the new model is 30 cfm at 100 psig. Model B-30-D is recommended by the manufacturer for use in combustion and process control, where dry, clean air is necessary.

Hankison Corp, 269 Biltmore Bldg, 951 Banksville Rd, Pittsburgh 16, Pa.



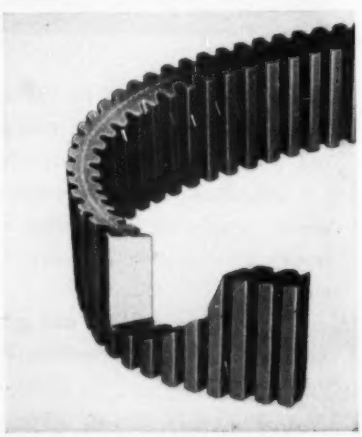
Mechanical Seal

535 • Heavy-duty mechanical seal will withstand pressures up to 1000 psi. Type 8-B shaft seal is furnished preassembled on a sleeve for ready installation. When used with split case pumps it is not necessary to lift upper half of casing to install or remove seal.

Unit incorporates a rotating sealing washer and a "floating" stationary seat. Balance is accomplished by lowering washer face to a point where stuffing box pressure is not exerted against sealing area. Mating surfaces of washer and seat are precision lapped.

Crane Packing Co, Dept P-29, 1800 W Cuyler Ave, Chicago 13, Ill.

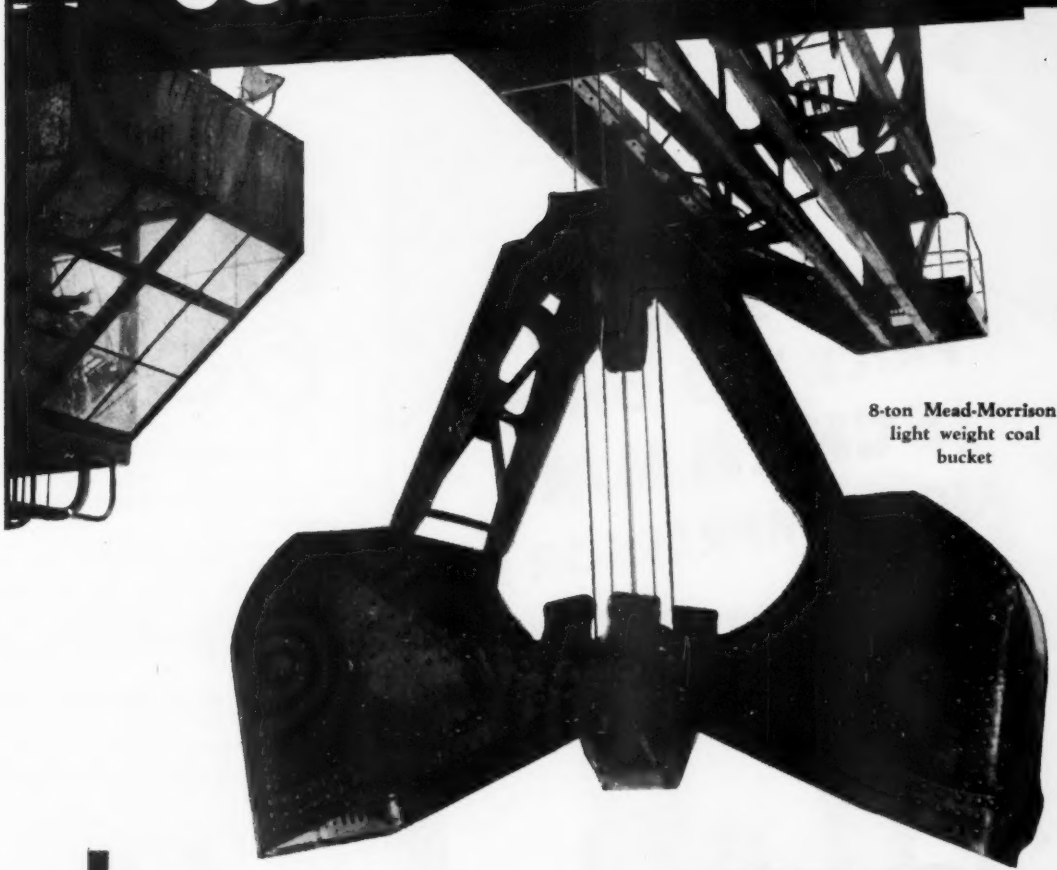
For more data on these items, use post cards p 169. Identify your request with item number.



Double-Ribbed V-Belt

503 • Double-ribbed V-belt reduces internal friction and permits greater flexibility without sacrificing strength. Greater speeds and smaller diameters can be combined

MEAD-MORRISON
COAL BUCKETS

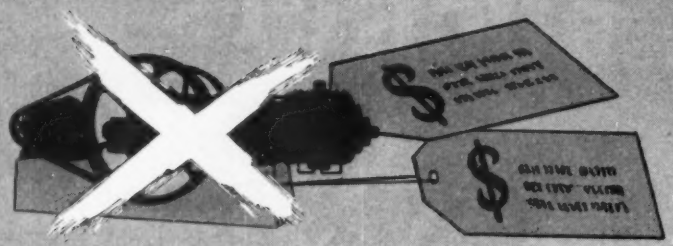


8-ton Mead-Morrison light weight coal bucket

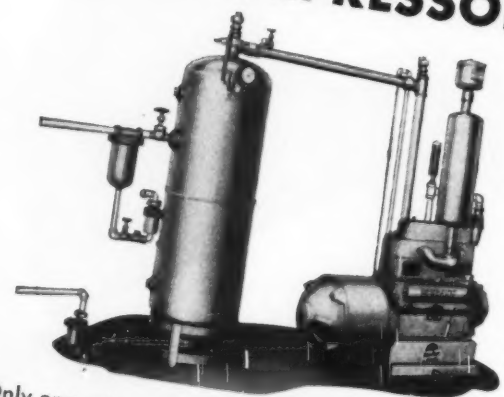
Constructed of light-weight tough alloys permitting maximum payload and saving in coal handling costs while assuring ample structural strength and digging ability. Built in a variety of types for a wide range of services and capacities.

Let our engineers help solve your bulk material handling problems. Bulletins available.

NO FOUNDATION COSTS!



THERE'S ONLY 1 PRICE TAG ON A SCHRAMM AIR COMPRESSOR!



Only one price — according to the size and model — that's all you have to pay for a SCHRAMM Air Compressor. No "hidden" extras such as foundation costs! And, did you ever stop to consider this item when buying an air compressor? It can be mighty costly — and yet can be eliminated — by using a SCHRAMM!

SCHRAMMS are compact, lightweight, truly versatile. *AND VIBRATIONLESS!* Add all these features together, pay only one price for them all — when you buy a SCHAMM AIR COMPRESSOR.

Write today for catalog 5110A.

SCHRAMM INC.

The Compressor People

WEST CHESTER • PENNSYLVANIA

More EQUIPMENT NEWS

Begins on page 160

when using new belt, manufacturer claims. The *Varibelt* is constructed of synthetic rubber compound, built up in layers, then cured under pressure in precision molds.

U. S. Electrical Motors, Inc, Box 2058, Los Angeles 54, Calif.

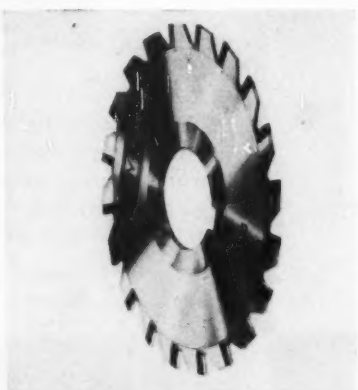
Photoelectric Counter

564 • Photoelectric counter set, PIC, is a completely packaged, easily installed, general-purpose unit.

Set consists of a photoelectric control, light source, and electric counter. Electric counter may be placed at any convenient location and wired to the control. Remote counting is thus easily obtained. Unit plugs into standard 115-v ac outlet. Bulletin PA506.

Photoswitch Inc, 77 Broadway, Cambridge 42, Mass.

For more data on these items, use post cards p 169. Identify your request with item number.



Contour-Tooth Saws

565 • Manufacturer announces availability of *Thinsaws* with contour tooth forms. A wide variety of convex forms, including radius and radius with angles tangent and their variations, can be produced to customer specifications.

Thinsaw carbide tips are brazed into a circular pocket. They are available in diameters up to 8 in. and in thicknesses of

Guaranteed GR Results

with the new

G-R fin-fan*

AIR-COOLED HEAT EXCHANGER

* *Improved design*
* *Wide application*
* *Dependable service*

WRITE FOR DETAILS

Designed, manufactured and serviced by

THE GRISCOM RUSSELL CO. · MASSILLON, OHIO

GR-514

• THE HILCO OIL RECLAIMER
• REMOVES WATER, SLUDGE, ACIDS
• IT IS CONTINUOUS AND AUTOMATIC

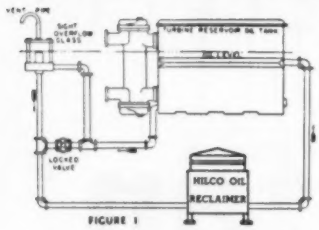


FIGURE 1

• The HILCO OIL RECLAIMER is self-contained, including built-in pumps, electric heaters, starters and controls. It is compact, easy, and quick to service.

• The HILCO system results in removing contamination as fast as it is formed, thus maintaining the oil in first class condition.

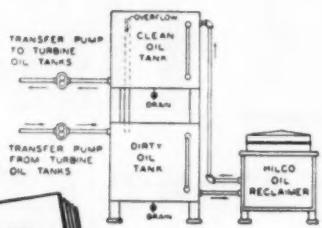


FIGURE 2

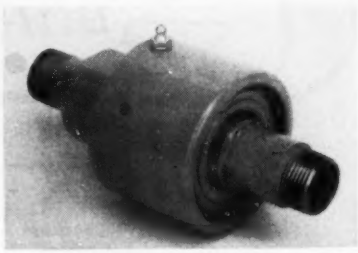
FOR MORE INFORMATION ON THE HILCO SYSTEM

More EQUIPMENT NEWS

Begins on page 160

.030 in. up. Solid carbide saws are available from .020 in. up. Either type can be produced with contour tooth forms so that proper resharpening does not destroy the contour.

Gay-Lee Co, Clawson, Mich.

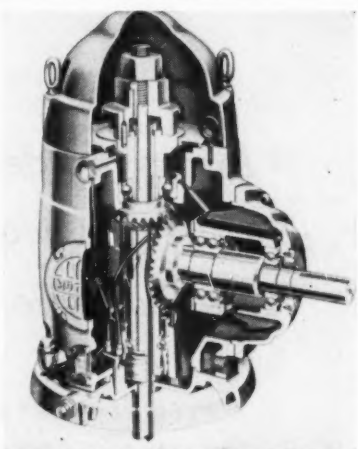


Rotary Pressure Joint

566 • Joint will convey steam up to 350 psi and liquids up to 3400 psi while rotating at high speeds. It has self-adjusting wear take-up and single or double race ball bearings. Efficiency of the sealing members cannot be affected by misalignment or eccentricity up to 10 degrees. Auxiliary seal prevents loss of grease or condensate. Unit withstands temperatures from –100 to +600 F. Joint is self-supporting, can be used with or without a syphon. Available in pipe sizes from ¼ up to 5 in. inclusive.

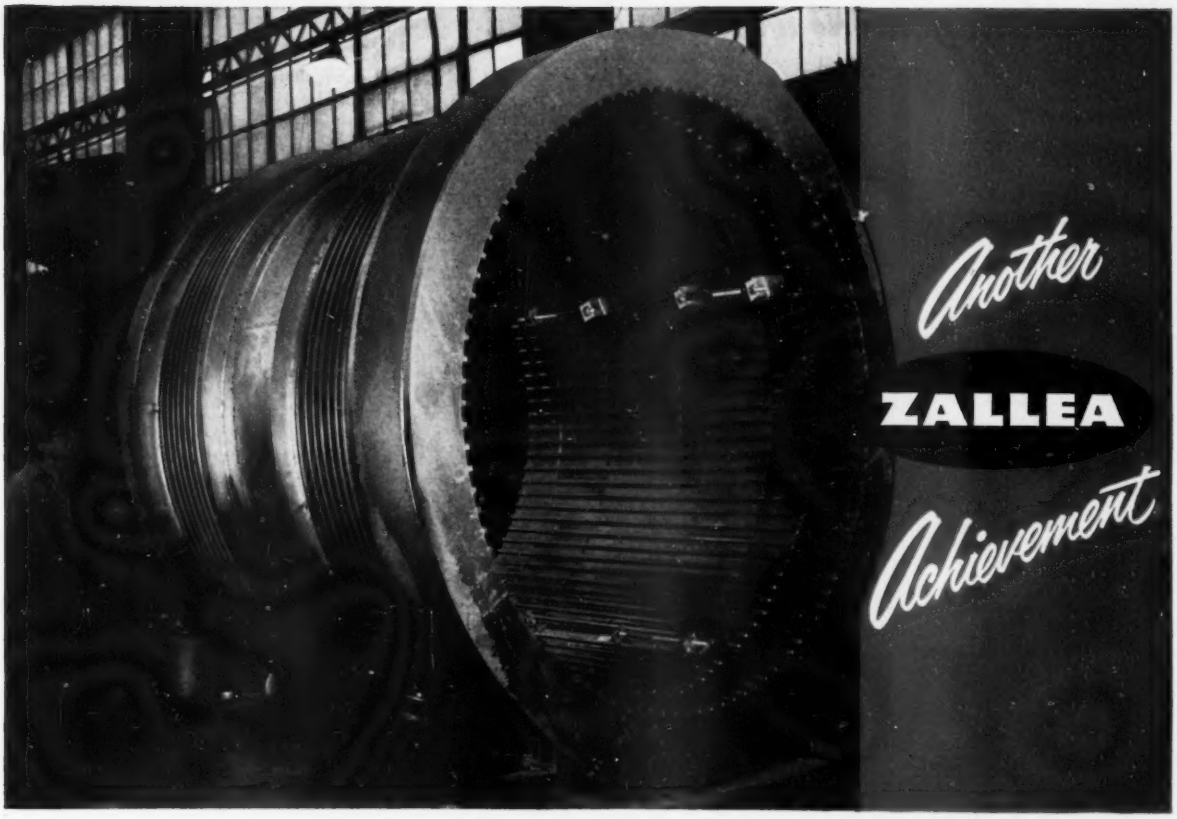
Anco, Inc, Dept 35, One Baker St, Providence, R. I.

For more data on these items, use post cards, p 169. Identify your request with item number.



Right Angle Gear Drive

567 • New U.S. *Holloshaft* drive operates deep well pumps where electricity is not available or where gas can be economically used for power. Unit can be used with gas, diesel or gasoline engine power up to 70 hp. Drive has constant cycling of oil that can be visually observed from the exterior. Thrust bearing set in the top can be removed without disturbing the hollow shaft or gears. Reverse protection clutch prevents pump shaft from becoming unscrewed in case of torque reversal, and the hollow shaft is adjustable to take up stretch in the



In the almost quarter century that we have been in business, we have been called upon to develop and produce many highly specialized types of expansion joints. None, however, have been more spectacular than the 109-inch joints recently developed for use in testing equipment for aircraft engine prototypes. These low pressure joints were designed with a hundred internal tie bars, which permit the joints to absorb the lateral deflection between a long exhaust header, operating at 650° F. and a series of large gas coolers, without the need for heavy anchors. Eight of these joints are now in service in a classified defense project.

This is just another example of how Zallea engineers, with the experience gained from specializing in one product—expansion joints, are able to successfully and economically solve the most difficult problems confronting this type of industry.

But this is not all—we regularly manufacture a complete line of expansion joints capable of service in virtually any type of expansion application. These joints are available in diameters from 3 inches to 30 feet for temperatures from subzero to 1600° F. . . . for pressures from vacuum to 300 psi in standard designs and up to 2,000 psi in special designs.

For full details regarding your expansion joint problems or requirements, just get in touch with us. Zallea Brothers, 814 Locust Street, Wilmington 99, Delaware.

For detailed information on Zallea Expansion Joints and services write today for a free copy of Bulletin 351.

Zallea
EXPANSION JOINTS

Your Management wants to know...

How to end the fly ash nuisance

PLANT ENGINEERS, working with Buell engineers, have proven again and again that their know-how coupled with Buell's long experience in Dust Collection can solve your Fly Ash problems more economically, more efficiently.

What's more, Buell Dust Collection Systems offer all American industry these further advantages: smoother plant-community relations, improved product quality and better employee morale.

Buell's knowledge and experience in the highly specialized science of Dust Collection are yours. To learn more about Buell's **3 basic systems** of Dust Collection and how they can help you, send for the new, informative booklet titled, "The Collection and Recovery of Industrial Dusts." Buell Engineering Company, Dept. 50-E, 70 Pine Street, New York 5, New York.

Van Tongeren Cyclone

'SF' Electric Precipitator

Precipitator-Cyclone Combination

Type 'LR' Collector

Dust Hopper Valves

ELECTRIC CYCLONIC ® buell

ENGINEERED EFFICIENCY IN DUST COLLECTION

More EQUIPMENT NEWS

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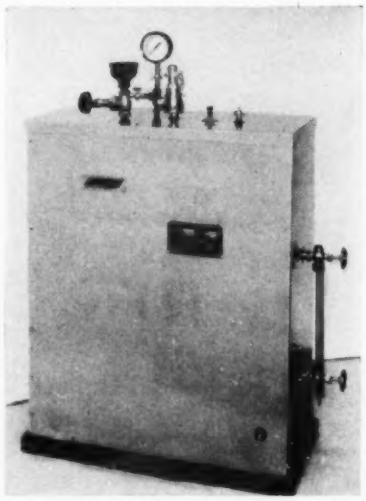
pump shaft. All internal moving parts are sealed against moisture and corrosion. Bulletin 1775.

U. S. Electrical Motors, Inc, Box 2058, Los Angeles 54, Calif.

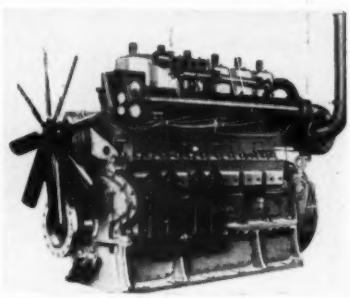


Electric Steam Generator

514 • Electrically operated steam generators employ electrodes instead of resistance heating elements. Designed for 220, 440 or 550 v, they operate most efficiently on the two higher voltages. Features claimed by manufacturer are: 98% efficiency with unity power factor, no tubes to scale, no blowdown, no water treatment required, one half to one third floor space of equal rating fuel fired units. Available to 60 bhp and pressures to 600 psi.

Livingstone Engrg Co, 100 Grove St, Worcester 5, Mass.

For more data on these items, use post cards p 169. Identify your request with item number.

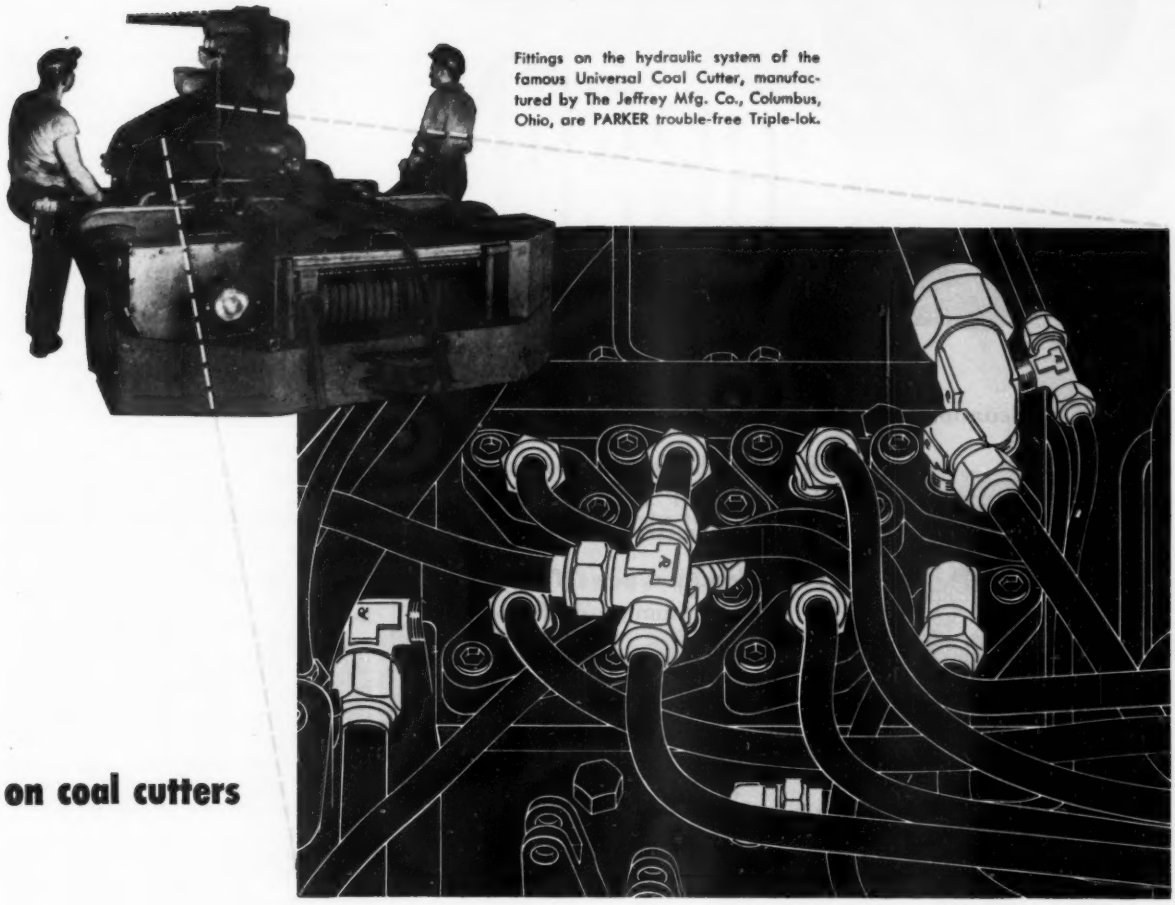


Turbocharged Diesels

531 • Five engine sizes, from 426 to 2894 cu in. displacement, now incorporate turbocharging. Manufacturer claims substantial power increases and greater fuel economy. Units use any standard diesel fuel.

All engines are heavy-duty, 6-cylinder, 4-cycle units. Power rating of the 426 cu in. engine is increased from 147 to 185 hp, the 2894 cu in. engine rating is increased from 406 to 570 hp.

Waukesha Motor Co, Waukesha, Wis.



Fittings on the hydraulic system of the famous Universal Coal Cutter, manufactured by The Jeffrey Mfg. Co., Columbus, Ohio, are PARKER trouble-free Triple-lok.

on coal cutters

Tube it up...Forget it...WITH PARKER

TROUBLE-FREE TRIPLE-LOK FITTINGS

Few machines get rougher use than coal cutters in coal mines. Subjected to severe vibration, caused by the action of the cutting head, and operating under the most adverse conditions, all parts must be ruggedly built, including the hydraulic system.

You'll find Parker Triple-lok Fittings on coal cutters and many other machines used in rough, rugged service because they are leakproof under the severest conditions of vibration, elevated temperatures, high pressures and repeated assembly. Parker Fittings meet the specifications of the A.S.M.E. Code for Pressure Piping, as well as J.I.C. and S.A.E. standards.

So *tube it up* and *forget it* . . . with Parker Triple-lok Fittings. Ask your Parker Distributor for Tube Fitting Catalog 4300, or write The PARKER Appliance Company, 17325 Euclid Avenue, Cleveland 12, Ohio.

This does it

Triple-lok . . . 3-piece flare fitting famous for its sleeve . . . the easiest way to install tubing systems. Made in brass, steel, stainless steel, aluminum alloy.

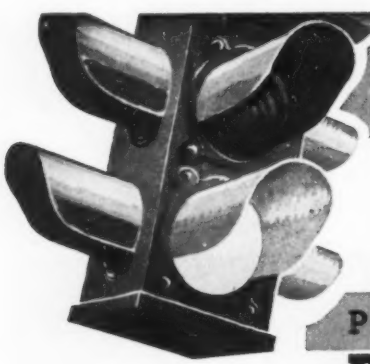
Precision Mark of

Leakproof Tube Fittings

Parker

TUBE FITTINGS • VALVES • O-RINGS

Plants in Cleveland • Los Angeles • Eaton, Ohio • Berea, Ky.

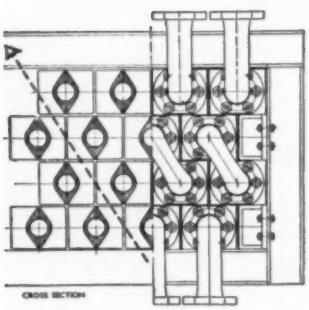


GREEN

PREMIER DIAMOND

ECONOMIZERS

The Economizer with the "Diamond" Design



Here are the four major values in the "diamond" shape of the Green Fuel Economizer:

1... Streamline flow of flue gases gives minimum draft loss

2... Finned tubes give maximum heating surface in given space

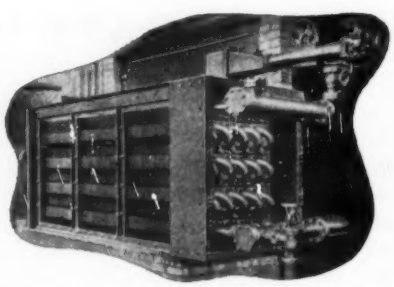
3... Staggered tube arrangement permits easy inspection

4... Minimum soot collecting surface is thoroughly cleaned by Green's "Special" Soot Blowers

Green Premier Diamond Economizers are available in either cast iron tube construction (Type 25) or steel tube construction (Type 12).

Pressure parts are rugged and joint flanges independent of support flanges.

Green Fuel Economizer's reputation of 60 years assures you of satisfactory performance and quality. Send for Bulletin No. 169.



THE GREEN *Fuel Economizer* COMPANY INC.

BEACON 3, NEW YORK

ECONOMIZERS • FANS • AIR HEATERS • CINDERTRAPS

MARMADUKE

Continued from page 148

"Tied up alongside the Fort was a tanker filled with 80,000 barrels of bunker fuel. It was Sunday, and most of the tanker's crew were ashore. Besides, she didn't have enough steam to get under way. And as tough luck would have it, there was no tugboat because the tugs were on strike. It was while the tanker's skipper was trying to get someone to pull his ship away from near the burning Fort that the Fort let go. And the tanker went up with her. But she spread her 80,000 barrels of burning oil all over the harbor and water front.

"Hobson and I had just polished off a few bottles of ale when we heard the explosion. And we were 12 miles away. The earth trembled and we saw clouds of smoke billowing into the sky from over the harbor.

"We hopped into our truck and headed back toward the city. Our ships were docked a few miles from the Fort, but we couldn't take chances. We hadn't driven far when another ship, this one with 3500 tons of explosives, let go. Talk about your atom bomb. For a mile inland any structure that wasn't flattened out caught fire.

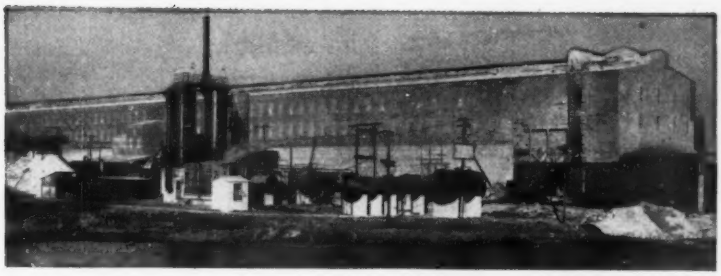
"By the time we got within a few miles of the water front, terrified natives blocked the streets as they fled from that inferno. We had one tough time getting through. Then I saw a naval escort ship blown clean out of the water and land on the quay. She propped herself against the building as if placed there by a gigantic hand.

"About the time we reached the dock area two other ships blew apart. Most of their parts landed on the dock buildings. Another ship blew into the sky a few minutes later. We knew that one of the *Sussex's* officers had been trying to help this last ship get under way because his arm, wrapped in part of his shirt, landed near us. The shirt had his name and the ship's name stenciled on the collar.

"About that time I saw a marine boiler making knots 100 feet above our heads, headed in the general direction of the holy Ganges River. We finally got to our ships—the only ones not damaged. It just happened that we were tied up in the one section of the harbor that escaped damage.

"For the next few days fires were still burning ashore. Explosives in warehouses and in what was left of wrecked munitions ships near the Fort were still going off.

"After the war I heard experts who had been there say that was about the biggest nonatomic blast anywhere. And in the swarming slums of the dock area



"I can't make a mistake"

says Jackson M. Spencer
Plant Lubrication Man
Southern Fertilizer and Chemical Co.
Savannah, Georgia

"'POCO' HT Grease B is the only grease used in our plant. It has replaced three competitive greases. It is the first truly multi-purpose product we have found to do all of our grease jobs, in a wide variety of equipment, in hot or cold weather, under all types of operating conditions—wet or dry.

"And Pure Oil's engineering service is definitely superior, too. If I follow your charts, *I can't make a mistake*".

Let us show you how to simplify and save with

PURE OIL INDUSTRIAL LUBRICANTS

Every day more and more industrial users find they can use Pure Oil lubricants to *reduce inventories . . . simplify procedures . . . minimize waste and error.*

For Pure Oil specializes in top-quality multi-purpose oils and greases designed to do several *different* jobs—instead of one specific job—and do each job *equally well.*

One of our representatives* will gladly give you full details. Or—for a free "Simplify and Save" booklet that tells how to start a labor-saving, money-saving lubrication program in your plant—mail the coupon today.

Be sure with Pure

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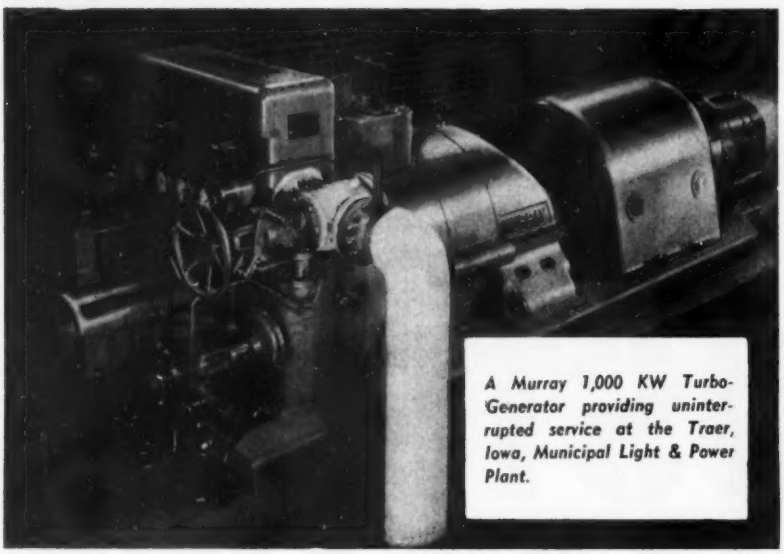
Murray Turbines



A Murray 1,000 KW Turbo-Generator providing uninterrupted service at the Traer, Iowa, Municipal Light & Power Plant.

● A typical, modern, small public utility is the Municipal Light and Power Plant at Traer, Iowa. This plant supplies water, steam heat and electric power to the community and surrounding countryside. The Murray turbo-generator pictured above carries the full electrical load of the plant and supplies the steam for heating by automatic extraction at 10# gauge pressure.

The simplified design and rugged construction of this and all MURRAY turbines particularly adapt them to this or any other drive where long life, reliability and low operating costs are a *must*.

MURRAY IRON WORKS COMPANY

BURLINGTON, IOWA

Builders of Steam Power Equipment for Three Quarters of a Century

MARMADUKE

Continued from page 200

alone, whole families were wiped out. The mayor of Bombay estimated that loss in life was around 300,000. I haven't seen figures for property damage, but it must have been unbelievable.

"And why did all that happen?" suddenly asked Marmaduke, glaring at me belligerently. "Because one bull-headed skipper refused to follow orders—that's why." He answered his own question before I could say anything.

"I never preach," he roared, "but one thing a responsible person has to learn is to take orders—not only hand them out. And if this story means anything to you," continued Marmaduke, turning back to his sketching, "go ahead and use it."

"Gosh," I kept saying to myself as I walked down the creaky stairs. "Old Marmaduke got THAT point across."

PEAK-LOAD POWER

Continued from page 104

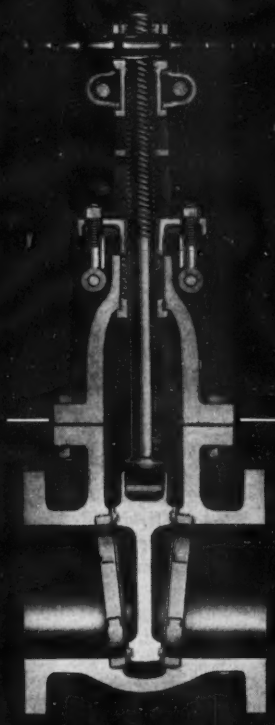
110-kv transformers and to the 110-kv bus. The two 70,000-kva generators do likewise through two 70,000-kva transformers.

From the 110-kv bus a double transmission line runs 250 miles to Vienna, and another line goes to the Tyrol. At Kaprun, three 100,000-kva, 110- to 220-kv transformers connect to a 110- and 220-kv double bus. From the latter a double transmission line runs to Vienna, and another is planned. Five more 220-kv lines are planned for the time when the project will be completed.

Construction Equipment. Hazardous mountain terrain, as shown in Fig. 1, where roads cannot be built economically, required special construction methods and equipment to carry men and material thousands of feet above the valleys. A 2-way cableway stretches 4.6 miles from the cement unloading plant at Kaprun in the valley to the Limberg concrete-mixing plant at an elevation over 3000 ft higher.

A 2-way cableway about 2.5 miles long extends from Mooserboden gravel plant to the concrete-mixing plant at 1050-ft higher elevation. Concrete was taken from the mixing plant to the dam by three 8.5-ton cable cranes operating on a 1878-ft span. A 4-mile 2-way cableway was built from Heiligenblut to the site of Margaritze Dam, more than 6000 ft above the valley, to transport men and material.

These are only part of the equipment used to solve the transportation problems on this great project. But they



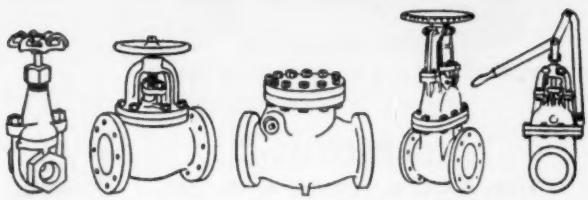
IRON

COMPLETE LINES OF IRON VALVES AND PIPE FITTINGS are manufactured by Walworth in a variety of types, pressure ratings, sizes, and patterns for general industrial use.

Walworth also manufactures complete lines of valves (including Lubricated Plug Valves), and pipe fittings made of steel, bronze, and special alloys.

These valves and pipe fittings, plus Walworth-made pipe wrenches total approximately 50,000 items and are sold through distributors in principal centers throughout the world.

Walworth engineers will be glad to help you with your problems. For further information call your local distributor, nearest Walworth sales office, or write to Walworth Company, General Offices, 60 East 42nd Street, New York 17, New York.



Iron valves in gate, globe, angle, check, and lubricated plug types are manufactured by Walworth. Illustrated is a sectional view of a Walworth No. 726F Standard Iron Body, Bronze Mounted, Wedge Gate Valve with flanged ends. This line of valves is available in sizes 2 to 30 inches. Similar valves of All-Iron type are also available.

WALWORTH

Manufacturers since 1842

valves . . . pipe fittings . . . pipe wrenches

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HOFFMAN
VACUUM PUMPS

NEW! VERTICAL MOTOR HIGH ABOVE DIRT AND WATER

If excessively hot condensate is a problem in your steam plant, this New Hoffman Vacuum Pump offers positive relief. The exclusive Jet-Type Vacuum Producer featured in all Hoffman Vacuum Pumps assures efficient operation under conditions ordinarily impossible. It is the most effective means known for simultaneously removing air and water from the system. Years of service cause no deterioration, as the Hoffman Jet has no moving parts to wear or score. As a result, *the Hoffman Vacuum Pump will handle hotter water than other types of pumping units.*

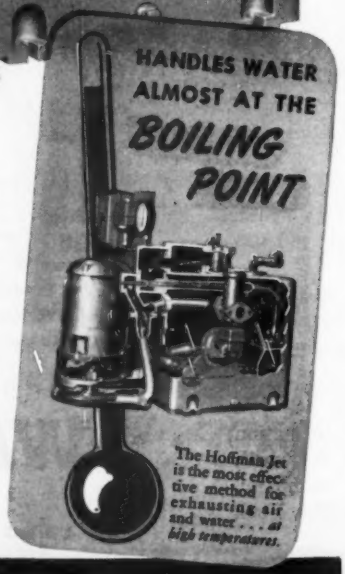
TYPES "VS" and "VSS" SINGLE UNITS
Available in duplex units

CAPACITIES:
From 2,500 to 100,000 sq. ft. EDR.

DISCHARGE PRESSURES
From 20 lbs. to 60 lbs. per sq. in.

● Bronze fitted throughout ● Enclosed, precision balanced bronze impeller ● Renewable bronze wearing ring ● Split bronze packing gland ● Stainless steel impeller hub ● Impeller has top suction inlet—eliminates air or vapor binding ● Rigid motor support, very quiet ● Easily handles 200°F condensate.

Write today for Cat. No. VP 852, no obligation.


HANDLES WATER ALMOST AT THE BOILING POINT
The Hoffman Jet is the most effective method for exhausting air and water . . . at high temperatures.

PEAK-LOAD POWER

Continued from page 202

give an idea of some of the difficulties the men had to master while contending with subzero temperatures and avalanches. These were major considerations in the design and construction of the project. Incidentally after the project is completed the cableways will be used to open up to tourists this mountainous region of superb beauty.

Kaprun plant is now in operation and according to schedule, Margaritze Reservoir and Moll tunnel went into operation near the end of 1952. The first Limberg turbine goes into operation late this year and its first pump goes into service in 1955, as do the Moll pumps. By the autumn of 1955 Mooserboden and Wasserfallboden Reservoirs are expected to be filled to capacity.

All four pelton turbines in the Kaprun plant were built by Escher Wyss, Ravensburg, Germany; the 70,000-kva generators by Elin AG, Wein-Weiz, Austria; the two 50,000-kva generators by AEG, Berlin, Germany. In the Limberg plant, Elin AG has the contract for the generators, and Escher Wyss for the francis turbines and pumps.

Acknowledgments. The author gratefully acknowledges the assistance in writing and checking this article given by Herr Kothbauer, director of Kaprun Tauren power plant in Austria; Fritz Kolb of the Austrian Embassy in Paris, and Robert F Hamilton, Power Consultant Industrial Resources, Mutual Security Act.

More PLANT PROBLEMS

Continued from page 137

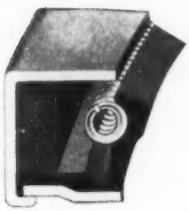
their knowledge valuable for many different jobs.

Start on the right foot by setting up lamp cleaning and replacement schedules. If you wait a few months to get the schedule started you may have difficulties. Use a good light meter to check illumination throughout the plant. Make a record of your readings for future reference.

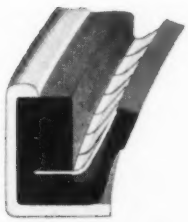
I'd look for a man with plenty of maturity for this job. I'd also be certain he wanted to stay and would be happy with his work. Also, *KL's* plant is an excellent place to train young men. I'd start several apprentices as soon as the plant opens, or earlier if possible. If a young engineering graduate can be hired, he'll give excellent help when it comes to computations, sketches, and other engineering jobs.

Don't load electricians with routine jobs like reading meters, writing up log sheets, or making out extensive records. It's better to have each man specialize

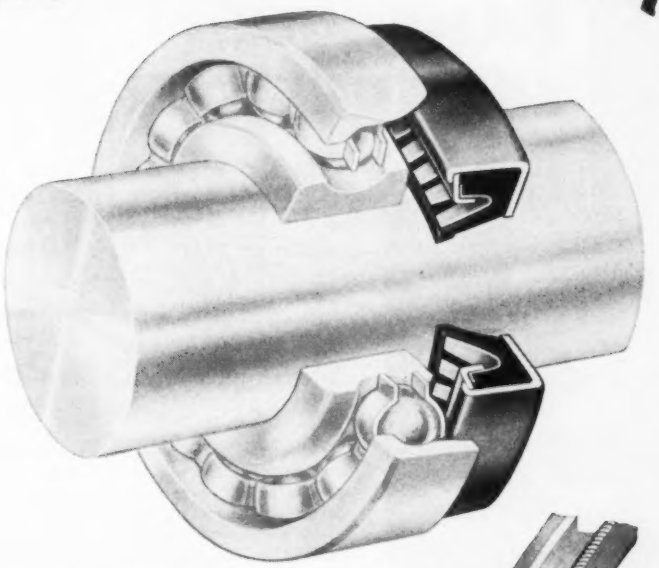
Best Bearing Protection Money Can Buy



Model 65—A general purpose garter spring seal for moderate speeds.



Model 63—A general purpose finger spring seal for normal and high speed service.



Model 53 KLOZURE applied to a shaft to protect the ball bearing.

Model 71-A—A narrow-rind springless seal for needle bearings and other limited space applications.

Model 64—A strong double spring seal for heavy duty service on large shafts.

Model 91-B—A narrow-rind seal with synthetic rubber outer covering for soft metal housings.

DEPENDABLE KLOZURE Oil Seals protect costly bearing installations; they prevent breakdowns and resulting losses in production. That's why many manufacturers of machine tools, gears, speed reducers, and other equipment have standardized on Garlock KLOZURES.

The standard sealing element in the Garlock KLOZURE is made of a synthetic rubber compound that is oil-resistant, non-porous and non-abrasive. Special elements, such as "Teflon" for strong acids and silicone rubber for extreme heat, are available. The metal cases are precision die-stamped.

These superior oil seals are made in a complete range of sizes and in many models; several are illustrated. *Write for KLOZURE Catalog No. 10.*

Branch Offices in Principal Cities

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK

In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.

GARLOCK Klozure* Oil Seals

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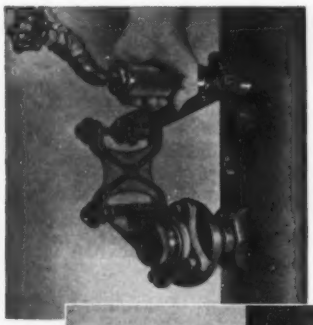
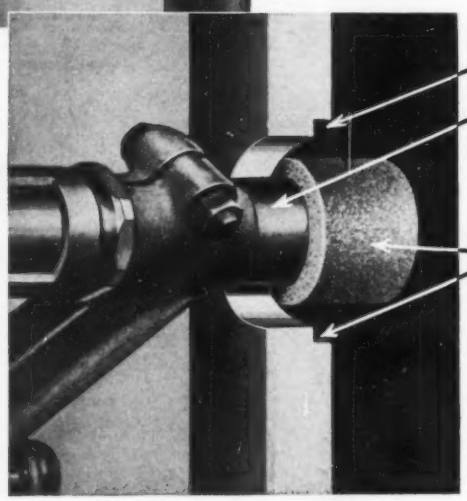
FOR ALL TYPES OF BEARINGS

Quick, easy and accurate job on refacing handhole seats with the



ELLIOTT HANDHOLE SEAT GRINDER


WIDTH OF SEAT
controlled by
GUIDE ROLLER
available in all sizes for seat widths from 3/16 in. to 21/32 in.
GRINDING WHEEL
acts as a surface grinder and is rigidly precision-controlled to move in a single plane which is the face of the seat, assuring positive flatness and a sure-tight seat.

Here is the modern time-saving and surely accurate way to reface handhole seats that have become corroded, scarred or wire-drawn. The grinding wheel of the Elliott handhole seat grinder is first inserted in the handhole to be refaced, then the base of the unit is clamped rigidly to the stud of an adjacent handhole, and leveled by adjusting the leveling screws. The plane of grinding, vertical to the axis of the hole, is fixed as to depth by the adjusting feed nut.

Setting up takes only a few minutes and the actual grinding only a few minutes more. Compare that to the labor and inevitable inaccuracy of hand filing or of a hand-held power grinder. Consider too, the certainty of *knowing* you have a tight seat, instead of the anxious testing and finding you haven't, when the pressure ultimately goes on.

Available with air drive, or electric motor as shown above. For details contact your local Elliott representative or write Elliott Company, Springfield, Ohio.

ELLIOTT Company

LAGONDA DIVISION

Y3-2

More PLANT PROBLEMS

Continued from page 204

in one phase of work so he becomes as competent as possible. Some of the important specialties needed in a large industrial plant include instruments, controls, telephones and alarms.

When plant runs around the clock you should have at least three master electricians, one for each shift. I suggest *KL* try this complement for his electrical department: 1 electrical engineer assisted by 1 junior engineer, 1 electrical foreman, 5 master electricians, 2 apprentices, 1 man for lamp maintenance, and 2 helpers for general work.

In a large plant like *KL's* there is probably a labor pool, from which additional helpers can be borrowed when needed.

C G Lewis *Vancouver, B.C.*

Feed-Pump Vibration

(*Continued from page* 138)

CHECK all suction piping. At 2400 rpm this type pump should have above it at least 15 ft of water, preferably 20 ft. This assumes water is boiling at its surface, as in a deaerator. More head must be added if there are many bends and fittings in the piping. If pump has enough static head, check piping.

When pump has a 6-in. suction connection it should be supplied by an 8-in. pipe with a reducer between pump and suction valve. If possible, pipe should rise to supply without any bends or loops that may trap vapor. If suction line has a bend or loop in it that may trap vapor, the loop's high point should be vented to supply tank or header.

Where a single line serves these three pumps, its size should be such that velocity in pipe does not exceed about 6 ft per sec.

Is boiler water in *BP's* plant scale-forming? If it is, he may find scale on balancing drums reduces clearance. This cuts leakoff rate, causes excessive axial thrust. When balancing drum corrodes, leakoff rate increases, causing excessive axial thrust. Check leakoff rate against manufacturer's guarantee and make any repairs necessary.

If all else fails, *BP* must assume pumps are not designed to run at 2150 rpm. Although unlikely, this could be a critical speed. Consult pump manufacturer. He may advise turning down the impellers enough to give the required head at 2400 rpm. But this is a last resort, to be done only with the manufacturer's advice.

Warren Badger *Catawba, W. Va.*

UNEQUAL EROSION of impeller vanes may create hydraulic unbalance that

NO GETTING AROUND IT!

De Laval Purifiers Minimize Sludge Formation

Water in turbine oil is a prime source of sludge formation. Since it is impossible to prevent a certain amount of water from getting into a turbine lubrication system, it is important to remove this water if sludge formation is to be minimized.

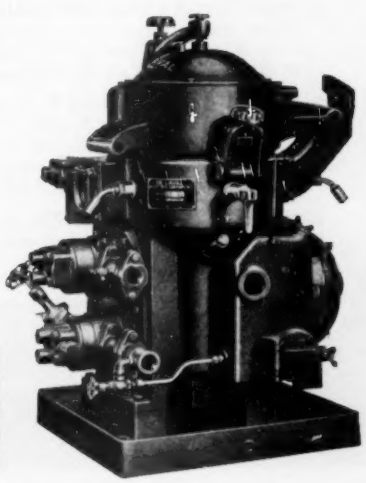
De Laval Oil Purifiers remove water from oil by means of centrifugal force, discharging the water continuously. If a sudden water leak should occur, the possibility of even more serious trouble is likewise minimized because the De Laval unit properly selected for size has ample reserve capacity.

At the same time a De Laval Oil Purifier removes ***dirt*** from the oil, storing it out of harm's way until it is convenient to clean the bowl. Because of the design of the De Laval bowl, there is no possibility of either water or dirt recontaminating the oil that has been purified.

In short, a De Laval provides maximum protection against ***both*** trouble-makers—water ***and*** dirt. Write for your copy of Bulletin TU-1.

THE DE LAVAL SEPARATOR COMPANY
Chicago POUGHKEEPSIE, N.Y. San Francisco

De Laval



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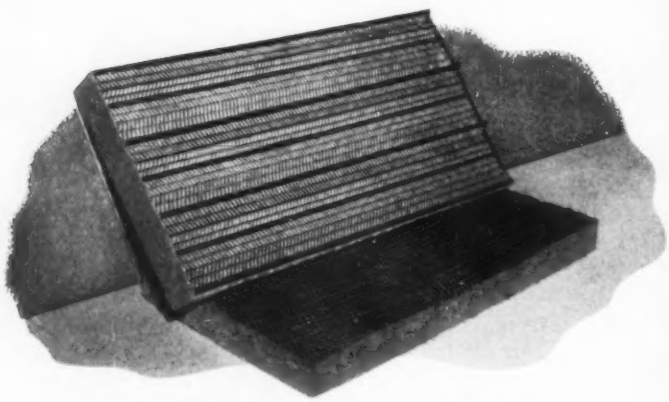
LAMINATED
Long-fibre BLANKETS



Vastly Improve Insulation
APPLICATION . . . EFFICIENCY . . .
PERFORMANCE!

Here's Why: Copr-fibre Blankets are made by laminating long, mineral wool fibres together to form a tough, resilient blanket *before wire mesh is attached.*

As a result this exclusive Copr-fibre two-stage manufacture gives you these advantages:

- **FASTER APPLICATION,** because laminated blankets cannot loosen or fall apart under the abuse of handling. And because Copr-fibre blankets come in convenient large sizes, are light in weight, clean, shot-free.
- **MORE INSULATING EFFICIENCY,** because laminated, longer fibres guarantee lower thermal conductivity. Two-stage manufacture is your insurance of uniformity of density and of consistency in all dimensions.
- **BETTER PERFORMANCE,** because resilient long-fibre Copr-fibre blankets maintain integrity, both of insulation and weatherproofing, throughout expansion and contraction cycles of heated and cooled equipment.

SEND FOR THIS BULLETIN. Copr-fibre Bulletin 511 gives you all the facts on what we believe is the only *modern* blanket insulation. Your copy will be sent free upon request. Write today.

Telephone: Aurora 9207

More PLANT PROBLEMS

Continued from page 206

leads to vibration. Though *BP* doesn't say anything about pump construction, I've seen impellers where leakage developed from one stage to the next through the keyway.

Be sure to check coupling alignment. It must be accurate and adjusted to compensate for pump expansion.

C W Bell, Sr. *Hazleton, Pa.*

NEGLECT TO USE bypass valves on light loads may be causing this trouble. If orifice-type bpyasses are used, check openings for clogging. Or *BP* might have a condition like one I ran into recently. The operator "couldn't stand all the racket" so he closed the bypasses.

Howard Holcombe
Los Alamos, N. M.

REBALANCE pump rotor if unit must run at 2150-2200 rpm. Only a pump manufacturer's engineers, or others specializing in this type of work, can do a job like this well.

Be sure all clearances in pump are within design limits and entire unit is securely bolted to its foundation.

John Geist *Brooklyn, N. Y.*

BE SURE pump operating temperature does not exceed design limit of 300 F. Otherwise, there may be flashing in pump suction. Use torque wrenches to draw up casing nuts. This prevents uneven tightening.

Check original drawings of the installation to see that piping to pump has not been changed. Rerouting of piping may put excessive strains on pump casing, causing misalignment.

Lag the pumps to keep temperature even throughout the casing.

Though *BP* can attempt to balance rotor, and may obtain satisfactory results, he should also check coupling halves and bearings. Replace worn bearings in turbine and pump.

Henry Rasmussen
Crystal Lake, Ill.

IN OUR PLANT we "smooth out" a pump by tearing it down and stripping the shaft of all impellers, interstage seals, spacer bushings, and balance piston if pump has one.

Our next step is to check shaft for run-out on lathe centers. If shaft is bent, we straighten it. After checking shaft we closely inspect all impellers for wear and cavitation. If they are not worn or cavitated, use them again.

Then we place each impeller on an arbor and face both sides square at one setting. We do the same for spacer

...with TYCOL lubricants on hand!

Top this record! A well known utility company has operated a turbine for *almost 12 years* without an oil change or cleaning. At a rate of less than 10% "make-up" per year, Tycol Aturbrio has served the plant without malfunction – for years on end. And Tycol Aturbrio performance records show turbine after turbine running well over 100,000 hours without a change! That's *proven stability* . . . further substantiated by the regular use of Aturbrio as an outstanding hydraulic oil. Full data on Aturbrio performance is available from your local Tide Water Associated office.

Over 300 Tycol industrial lubricants are at your disposal . . . engineered to fit the job!

REFINERS AND MARKETERS OF VEEDOL . . . THE WORLD'S MOST FAMOUS MOTOR OIL

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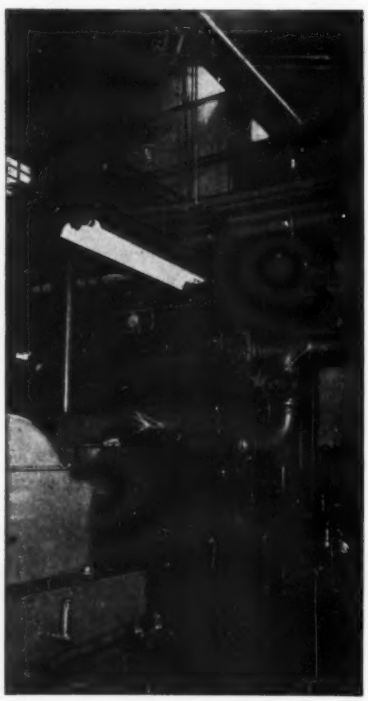
You Get Trustworthy Liquid or Gas Cooling With Great Cooling Water Savings from the NIAGARA AERO HEAT EXCHANGER

● You can cool air, gas, water, oils, chemicals, electric and power and process equipment, engines, mechanical processes with lower cost and really accurate control of temperature with the Niagara Aero Heat Exchanger.

You are assured of uniform, constant production and quality from any process . . . steady, reliable operation . . . lower cost for more dependable cooling. You can have closed system cooling with freedom from scale, dirt, corrosion and maintenance troubles. You can accurately cool more than one type of liquid with one machine.

The Niagara Aero Heat Exchanger uses atmospheric air to cool liquids and gases by evaporative cooling. You can remove heat at the rate of input to keep accurate control of gas or liquid temperature. You can put heat back into the system to save the losses of a "warm-up" period or to equalize the effect of load variations.



Great savings in cooling water and savings in piping, pumping and power return the cost to you quickly. The Niagara Aero Heat Exchanger can save you approximately 95% of your cooling water cost. Write for Bulletin 96.

NIAGARA BLOWER COMPANY

Over 35 Years Service in Industrial Air Engineering

Dept. P, 405 Lexington Ave. New York 17, N. Y.

Experienced District Engineers in all Principal Cities of U.S. and Canada

More PLANT PROBLEMS

Continued from page 208

bushings, balance piston and sleeves. Remember, any spacer that is not square causes the shaft to bow.

We metalize sleeves and bearings needing this treatment. After pump is reassembled we check it carefully for alignment. Unit should run smoothly if suction and discharge heads are within design limits.

D P SCHOTT *Saginaw, Mich.*

Two other readers answering this question are:

C G HOWARTER *Canton, Ill.*
HARRY DIXON *Port Alice, B.C.*

Converting Heating Plant

(*Continued from page* 140)

ing steam needed. As initial pressure on a valve decreases so does flow capacity. With two boilers producing a total of 10,000 lb per hr, a 3½- or 4-in. valve is suitable for reducing pressure from 125 psig. But with an inlet pressure of only 15 psig, an 8-in. reducing valve is needed. It will pay *LW* to investigate if pressure reduction to 5 psig for heating steam is necessary. He may be able to use 15-psig steam in heating lines and radiators.

If 15-psig steam is used, investigate condensate-return system. Pressure differential across traps will be higher and traps may not open.

Sketch *A* shows my idea of how *LW's* return system is piped. Though not all valves and other fittings are shown, receiver and pump for returning water to boiler are illustrated. If pressure in boilers is reduced to 15 psig, it may be possible to use return trap instead of a pump to return condensate to boiler. sketch *B*.

EDGAR MOSS *New York, N. Y.*

Production of useful amounts of electric power by nuclear energy has been achieved from successful operation of a new type of reactor—the experimental homogeneous reactor—at Oak Ridge National Laboratory, it was announced today by Union Carbide and Carbon Corp, which operates the Laboratory for the Atomic Energy Commission. At 1 am on February 24, scientists brought a pilot-model of the unique reactor system up to its full design power of 1,000 kilowatts of heat output. The reactor steam then was switched to a turbine-generator and about 150 kilowatts of electricity was produced. This is enough electricity to meet the estimated needs of 50 average five-room dwellings.

Compare

CHASE® COPPER BUS CONDUCTORS WITH ANY OTHERS . . . . . for capacity
. . . for copper savings
. . . for efficiency

Chase ventilated square tube buses can cut your copper requirements up to 36% as compared with flat rectangular bars.

The current ratings of some of the Chase ventilated square tube buses are given in the table to the right. Bear in mind that the square tube bus is a one-piece bus and is not a composite bus consisting of two or more parts.

Send for Chase Copper Bus Conductor booklet giving information on Chase ventilated square tube, flat rectangular and round copper tube buses.

CURRENT CARRYING CAPACITY OF ONE-PIECE BUS

	Square Inches	Current Rating at 40° C. Rise
7 x 7 x 3/8 Ventilated	9.06	7760
8 x 8 x 5/16 Ventilated	8.80	8400
9 x 9 x 1/4 Ventilated	7.93	8560

Chase BRASS & COPPER

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass & Copper

Albany†	Cleveland	Kansas City, Mo.	New York	San Francisco
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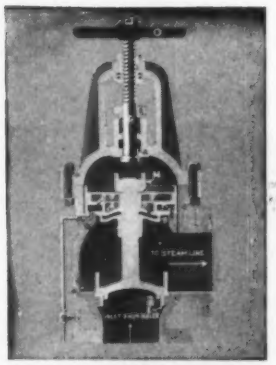
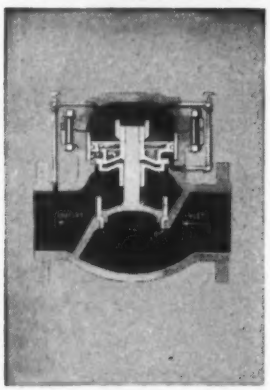
Boston	Detroit	Minneapolis	Providence	
Chicago	Houston	Newark	Rochester†	(†sales
Cincinnati	Indianapolis	New Orleans	St. Louis	office only)





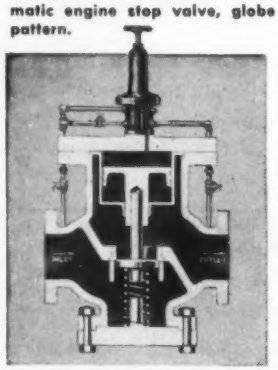
Reading from top to bottom:

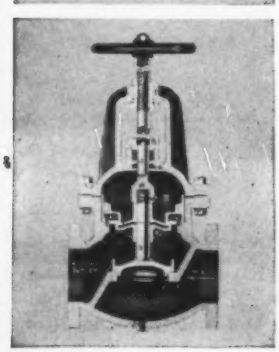
G-A double-cushioned single-acting non-return valve, angle pattern.

G-A double-cushioned check valve, globe pattern.

G-A cushioned unloading valve, globe pattern.

G-A combined throttle and automatic engine stop valve, globe pattern.

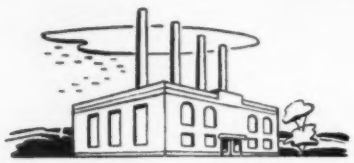




Your best

PROTECTION

against sudden shock,
"hammer" and costly damage



GOLDEN-ANDERSON

Automatic

Cushioned

Steam plant

VALVES

Golden-Anderson Valves have proven efficiency, quality and dependability for over 35 years in the tough applications put to them by America's industrial and power plants. The cushioning arrangement in all G-A valves permits them to operate smoothly at all times.

Golden-Anderson designs and builds over 1500 types and sizes of valves for engineered protection and high pressure installations. Let our experienced engineers help you on your next valve problem.

GOLDEN ANDERSON

Valve Specialty Company

2070 KEENAN BUILDING • PITTSBURGH 22, PA.

More ARGUMENTS

Begins on page 142

valve slowly when the line empties into a flash tank.

When dead boilers are overhauled, check valves eliminate danger of blow-down steam from other boilers backing up and scalding someone. Of course, all operators are warned not to blow-down while any boiler is in repair, but the checks are life insurance against accidents and misunderstandings.

EDWARD DELNICK
Valley Stream, N. Y.

Which Valve Should You Open First?

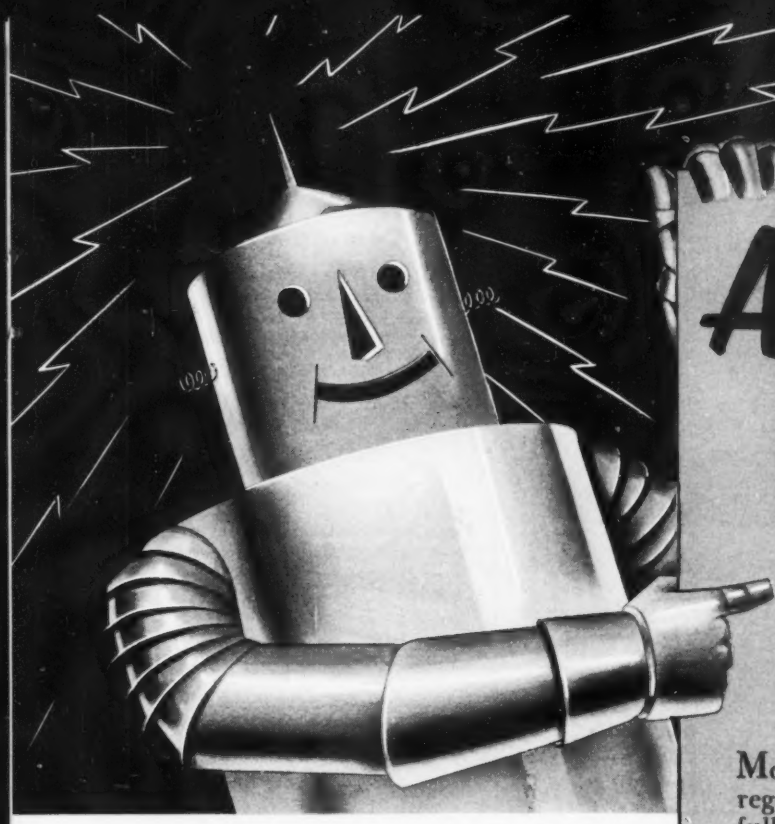
H ORTNER'S QUESTION, "Which Valve Should Be Opened First?" (POWER, Mar, p 138), draws attention to an error that will be presumably corrected in latest edition of our book, *Steam Plant Operation*, Woodruff and Lammers (McGraw-Hill Book Co).

The statement in question should read, "The quick-opening valve is opened first and closed last." This also agrees with our comments in chapter 6, "Operation and Maintenance of Steam Boilers" (p 242, par 2). We certainly thank Ortner for his accuracy, and interest in bringing this up.

H B LAMMERS *Cincinnati, Ohio*

Johannesburg—(McGraw-Hill World News) —What is believed to be the first outdoor power station outside of the U. S. is to be erected at Salisbury, Southern Rhodesia. A feature of the plant will be the use of pulverized coal boilers.

Power generation at the Ross Dam of Seattle City Light began Dec. 15. A second generator is scheduled to "go on the line" Feb. 1 and a third May 1. Ross Dam, 540 ft above bedrock, was started in 1937 and completed in 1948. Storing summer floodwaters has made possible full-scale operation of the Diablo and Gorge plants downstream on the Columbia River. The first generator originally was not scheduled to go into operation until next year but Seattle City Light, at the request of DEPA, speeded up the program. The powerhouse, when completed, will double City Light's hydroelectric capacity and greatly reduce the present necessity of buying power from the Bonneville Power Administration. After completion of the Ross powerhouse, next step in development of the Columbia River is expected to be a new Gorge Dam, 100 ft higher than the present structure, which would add about 50% to the present output of the Gorge plant. A later possibility is a 125-ft addition to Ross Dam.



AUTOMATIC

Demineralization and Silica Removal by Ion Exchange Resins

MOTOR and diaphragm-operated valves make regeneration of Permutit Demineralizers fully automatic. This gives more positive control . . . eliminates the possibilities of costly errors . . . saves valuable man-hours formerly spent in regeneration.

In a recent installation for a 1450 psi boiler, two compact Permutit units fill all make-up requirements, regardless of changes in turbine loads . . . deliver a continuous supply of demineralized, silica-free water. What better way to eliminate scale and silica deposits!

HIGHEST PURITY MAKE-UP

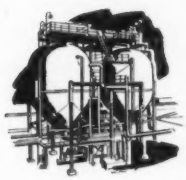
Effluents of Permutit Demineralizers have contained *total* electrolytes as low as 0.01 ppm and silica as low as 0.01 ppm! These values may be slightly higher under service conditions. In comparison, most distilled water contains 20 to 100 times more electrolytes . . . yet costs much more to produce.

INFORMATIVE NEW BULLETIN

You'll want this interesting book. Flow diagrams, illustrations and specifications explain key methods of demineralizing water and removing silica by ion exchange. Write for your copy, today!

THE PERMUTIT COMPANY, Dept. P-5, 330 West 42nd Street, New York 36, N. Y., or the Permutit Company of Canada, Ltd., 6975 Jeanne Mance Street, Montreal, P. Q.

OTHER BASIC WATER CONDITIONING PROCESSES

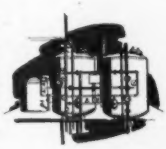


Sludge Blanket Hot Lime Soda

Full utilization of Permutit sludge-blanket principle assures high efficiency. Reduces hardness to region of 20 ppm . . . silica to 2.0 ppm. Lowers alkalinity . . . removes wide variety of solids.

Hot Zeolite—Permutit Q

Permutit Q—a styrene base resin resistant to high temperatures and pH values—replaces second stage phosphate treatment in hot-process softener. Results—residual hardness is completely removed at great savings in phosphate costs.



Deaerating Heater

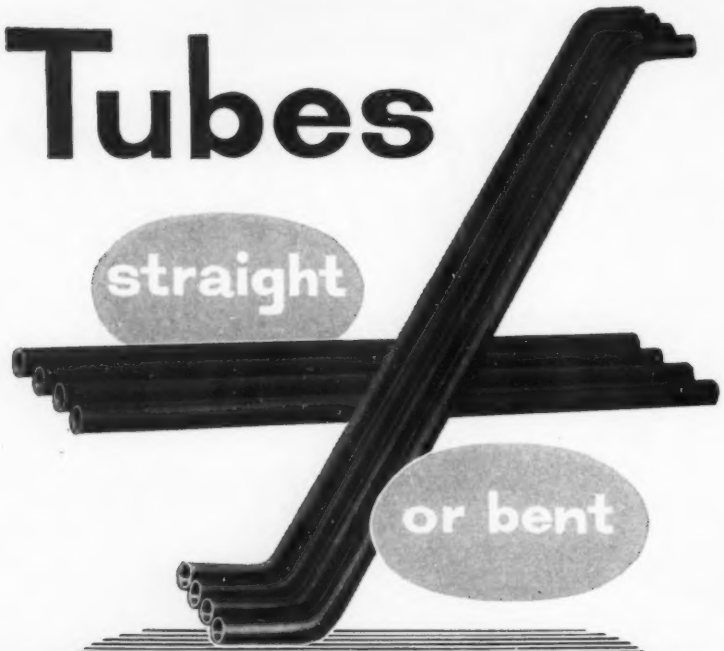
Removes objectionable oxygen and CO_2 to prevent corrosion and pitting of feed lines, stage heaters, economizers, and boilers at high temperatures. Steam is used twice . . . deaerates water completely.

Precipitator

Softens water on space and time-saving sludge-blanket principle. Simultaneously removes turbidity, color, fluorides, reduces silica and lowers alkalinity.

PERMUTIT

ION EXCHANGE AND WATER CONDITIONING HEADQUARTERS FOR OVER 40 YEARS



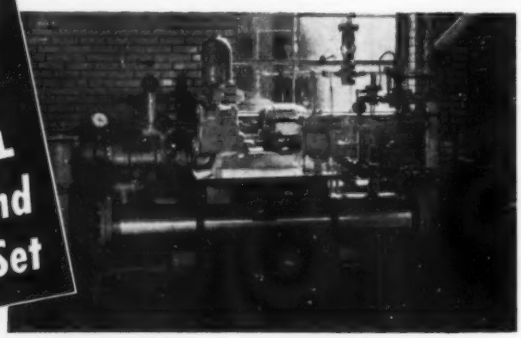
BOILER TUBE CO. OF AMERICA

McKEES ROCKS, PA.

(Pittsburgh District)

PITTSBURGH • CHICAGO • FRED S. RENAULD & CO., LOS ANGELES

ENCO DUAL FUEL-OIL Heating and Pumping Set



Two heaters and two pumps—one steam, one electric driven—in one set with these six features:

1. Completely automatic operation with temperature and pressure regulation.
2. All essential equipment—including safety valves as needed—in one compact unit.
3. Individually designed to meet the specific needs of the power plant.
4. All parts visible and accessible for easy operation, maintenance and repair.
5. Pumps run at moderate speed. Heaters designed to give the correct viscosity and velocity without fouling.
6. Cleaner boiler room . . . all overflows connected to a common outlet, flanged drip pan for pumps catches oil drip.

EC490

THE ENGINEER COMPANY

75 WEST STREET, NEW YORK 6, N. Y.

IN CANADA: ROCK UTILITIES LTD., 80 JEAN TALON ST. W., MONTREAL, P. Q.

More POWER NEWS

Begins on page 154

Coming Events

June 3-5—Wisconsin Power Conference & Exposition, annual meeting Schroeder Hotel, Milwaukee, Wis. L E Hoppe, Sec, 2335 N 58th St, Milwaukee 10, Wis.

June 15-19—American Institute of Electrical Engineers, summer general meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. AIEE, 29 W 39th St, New York 18, N. Y.

June 16-19—American Welding Society, spring technical meeting, Shamrock Hotel, Houston, Texas. AWS, Suite 1006, 12 E 41st St, New York 17, N. Y.

June 29-July 3—American Society for Testing Materias, annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. J W Sifton, ASTM, 1916 Race St, Philadelphia 3, Pa.

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ital expenditure, business plans to spend $23.3 billion on new plant and equipment in 1953—a 6 per cent increase over last year. And the outlook for 1954-56 already shows a projected level well over $18 billion each year.

Zirconium Vital In Atom Sub Engine

When Westinghouse Electric Corp started work on the first submarine reactor, large quantities of scarce and expensive zirconium metal were needed in a hurry. So they set about making their own.

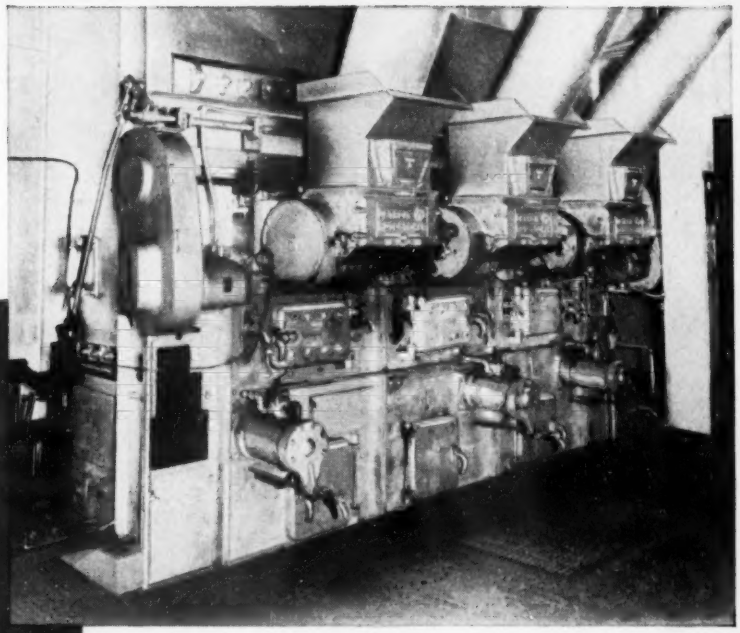
Zirconium metal is lighter than steel. It has remarkable corrosion resistance, an extremely high melting point, and is a fine structural metal in that it is strong and workable. Most important for its use in a nuclear reactor is the fact that it does not "waste" neutrons—the atomic particles that split uranium atoms and keep the atomic engine running. Whereas some metals "absorb" these neutrons and thus interfere with atomic fission, zirconium offers no such interference.

The job of boosting zirconium "crystal bar" from several hundred pounds per month, at $250 a pound, to thousands of pounds per month was completed in 14 weeks. At one point the scientists were stumped over finding a gasket that would give a positive, airtight seal, stand up under high temperature, yet could be removed frequently. They finally settled on wire of pure gold. It was soft enough for a perfect seal, stood temperature and corrosion

15% FUEL SAVING

with a

NEW DETROIT ROTOSTOKER FIRED BOILER



This installation, at General Mills, Inc., Buffalo, N. Y. plant is typical of Detroit RotoStoker performance. Not only was there a 15% fuel saving—smoke nuisance, long a problem, was eliminated.

Detroit RotoStokers burn economically any Bituminous Coal or Lignite without special preparation. They increase boiler capacity and respond quickly to sudden changes in load. Fuel is fed by efficient Overthrow Rotors. Fine fuel is burned in suspension—coarser fuel on the grates with uniform, but comparatively thin fuel bed.

Hundreds of Detroit RotoStokers are successfully applied to all makes and types of boilers or steam generators.

Do you need more steam at lower cost? If so, investigate the RotoStoker. Write for Catalog.

6215

DETROIT SINCE 1898 STOKERS

DETROIT STOKER COMPANY

General Motors Building · Detroit 2, Michigan

Works at Monroe, Michigan · District Offices in Principal Cities

A TALL STATEMENT that can give you FAT SAVINGS on WATER SOFTENING:

Nalcite HCR®
(DOWEX*)
offers three times the softening capacity of non-resinous exchangers.

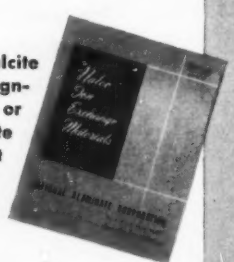
TALL as it may seem, this statement has been proved in every case where Nalcite HCR has replaced non-resinous zeolites. Many cases, in fact, show four times greater capacity for Nalcite HCR.

In water treatment, higher capacity means greater efficiency and greater economy. Higher capacity means more soft water at lower regenerant cost. Higher capacity means longer softener runs, less danger of hardness leakage.

Physically and chemically stable Nalcite HCR, pound for pound of regenerant, offers greater softening capacity than any other cation exchanger available today. Ask us about it.

TECHNICAL HELP ON WATER SOFTENING PROBLEMS

Nalco Bulletin 58 gives basic information on Nalcite HCR, designed to be of sound assistance in designing new softening plants, rebuilding old ones, or simply converting existing facilities for Nalcite HCR high performance. Your copy will be sent free upon request.



NATIONAL ALUMINATE CORPORATION
6222 West 66th Place • Chicago 38, Illinois
In Canada: Alchem Limited, Burlington, Ontario
*Reg. Trademark of The Dow Chemical Company.

A Nalco® PRODUCT • *When you use Nalcite resins, you take advantage of Nalco's long and broad experience in water and process technology.*

More POWER NEWS

Begins on page 154

well, and could be reclaimed after each using indefinitely.

The production process begins with zirconium "sponge"—porous chunks of metal that looks like coke. The sponge is loaded into a big tank that also holds a container of zirconium tetra-iodide—a combination of zirconium and iodine. A series of four-foot-long hairpin-shaped zirconium wire filaments are hung from the cover of the tank, which is put in place with its gold wire gasket. After the tank has been heated in a salt bath and evacuated, electric current is passed through the zirconium wire. This starts a chemical reaction.

Zirconium tetra-chloride vaporizes and deposits pure zirconium on the hot wire filaments. Freed iodine then migrates back to the remaining sponge material, and the cycle begins again until a considerable thickness of zirconium is deposited on the wire hairpin. The resulting crystal bars are chopped into small pieces and melted down into ingots to be eventually forged and rolled.

Models Used to Determine Transformer Transient Voltages

A new and successful method of determining transient voltages in transformers by using electromagnetic models has been developed by the General Electric Co's Power Transformer Department at Pittsfield, Mass.

The electromagnetic model reproduces faithfully the voltage magnitudes and wave shapes between any two points in a transformer, for applied waves of all types, and for all transformer connections. Its applications include: improvement of transformer designs; development of radically new winding structures; failure detection; and prediction of how a transformer behaves as a part of the power system.

Models requiring only a fraction of the time and cost of a large power transformer will be built for most GE transformers rated 100,000 kva and above, and all transformers having complicated winding designs.

Belgrade—(McGraw-Hill World News)—The rivers of Yugoslavia are being considered for a leading role in the development of electric energy resources for Europe. Studies made by the United Nations Economic Commission for Europe, estimate the hydro-electric capacity of Yugoslav rivers at 50 billion kilowatt-hours per year, of which less than 5% is at present being exploited. This potential capacity is only exceeded in Europe by Norway and France.

ABOVE: Vital to the high production maintained by Gunnison Homes, Inc. is this 650-ton hydraulic press used to bond plywood panels into strong, durable wall sections.
LEFT: Handsome, precision built homes, like the Gunnison Coronado pictured here, are built in a matter of hours.

Answers a pressing need for Gunnison Homes, Inc. . . .

● Gunnison Homes, Inc., situated in New Albany, Indiana, is one of the leaders in the field of manufactured homes. Key to continuous production of precision built homes at the New Albany plant is the 650-ton hydraulic press, shown above, which was installed in 1947. This press processes ten plywood panels every cycle by the combination of heat and pressure . . . a tough job and one requiring reliable hydraulic performance to maintain production schedules.

STANOIL Industrial Oil was installed in the press when it was put into operation six years ago. STANOIL has stood the test of severe operation . . . with no evidence of oil deterioration being found during a recent inspection of the hydraulic system. Operation has been efficient. Minimum make-up oil has been needed to maintain the oil capacity of 450 gallons.

STANOIL
TRADE MARK
Industrial Oil

Find how STANOIL can benefit you by discussing this multi-purpose oil with a Standard lubrication specialist. You can contact him by phoning your local Standard Oil office. Or, write: Standard Oil Company, 910 S. Michigan Ave., Chicago 80, Ill.

What's YOUR problem?

Ralph E. Murnahan, of Standard Oil's Evansville office, is the lubrication specialist who keeps in constant contact with Gunnison Homes to make certain that there is no interruption of operation due to lubrication difficulties.

He is one of many lubrication specialists who make their headquarters in Standard's offices throughout the Midwest. These men have been specially trained in Standard's Lubrication Engineering Schools and, in addition, have a wealth of on-the-job experience.

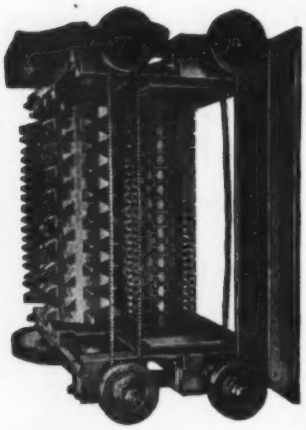
To obtain the service of the lubrication specialist in your area, you need only call your local Standard Oil office. The lubrication specialist will discuss your lubrication problems with you . . . at no obligation to you, of course. He has a complete line of petroleum products to offer you, including:

SUPERLA Greases—Available in a wide range of consistency grades and in both lime-soap and soda-soap types. SUPERLA Greases cover a wide range of operations. These efficient products are comparable in quality with the highest type of special greases.

STANOLITH Greases—Because these unique lithium soap products possess the heat resistant properties of soda-soap greases and the water resistant properties of lime-soap greases, they offer a solution to lubrication problems caused by the presence of both heat and water.

STANDARD OIL COMPANY

STANDARD *(Indiana)*



TWO BLADE — DOUBLE ADJUSTMENT

Crusher is pictured without hopper and sprocket guards, but is delivered complete.

WRITE TODAY FOR CRUSHER BULLETIN P-3

Two Stage CRUSHING IN ONE MACHINE!

"Two Stage" Coal Crusher incorporates two crushing stages in one machine and is designed to reduce RUN-OF-MINE to STOKER COAL in ONE operation. Compact design simplifies structural supports and installation. Rugged simple construction combined with engineering proved in the field makes this machine a profitable and reliable unit.

Fulfilling an urgent need in the industry, the GUNDLACH "Two Stage" Crusher has delivered over 85% usable stoker coal from an Illinois mine run lot.

All Gundlach Crushers are equipped with Gundlach Patented Crushing rollers. (Pat. No. 2578540)

MATERIAL SIZE CAN BE CHANGED WHILE MACHINE IS RUNNING

T. J. GUNDLACH Machine Co., Belleville, Ill.

More POWER NEWS

Begins on page 154

Underground Corrosion of Galvanized Steel Pipe

A study of underground corrosion of hot-dipped galvanized steel pipe has recently been completed by the National Bureau of Standards. Results confirm previous NBS work by showing that galvanized steel having 3 ounces of zinc per square foot of exposed surface is highly resistant to corrosion in many soils which are very corrosive to bare steel.

For the Bureau's study, short lengths of both galvanized and uncoated steel pipe, and also plates of zinc, were buried at 15 test sites for periods up to 13 years. The sites, located in widely separated parts of the United States, represented a wide range of soil properties.

Zinc coatings gave good protection in most of the soils. In one soil in which bare steel pipe was perforated by corrosion after exposure for only a few years, the coating on the galvanized specimens remained perfectly continuous for the entire 13-year period. In only two of the 15 soils, both organic, was the zinc coating of negligible protective value.

In order to get maximum life from galvanized pipe in practice, it is necessary either to construct the entire piping system of galvanized pipe or else electrically insulate the galvanized sections from pipe of other metals. Otherwise, the zinc coating will be removed by galvanic action.

The General Electric Co will manufacture the first large generator with liquid-cooled conductors in the history of the electrical industry. A new method of circulating a liquid through hollow conductors will be used in the stator of a turbine-generator set for the new Eastlake power plant of the Cleveland Electric Illuminating Co.

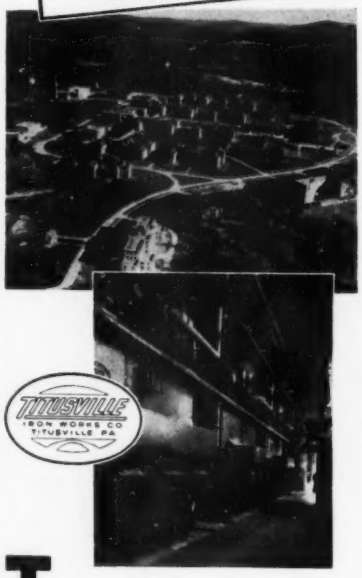
The unit, consisting of a tandem-compound turbine rated at 208,000 kilowatts and a generator rated at 260,000 kva, will be one of the largest in the world. This generator, alone, will be capable of supplying the household electrical needs of 600,000 people.

Other technical features of the Cleveland machine include direct cooling of the rotating field winding with hydrogen, a new and improved grain-oriented strip steel in the magnetic portion of the armature, and an improved type of insulation.

GE is also supplying three conventional hydrogen-cooled units, each of 125,000 kilowatts capacity, for the Eastlake plant, which will go into operation this summer. The 208,000 kilowatt generator is scheduled for installation by the end of 1955.

Dependable POWER—HEAT

for a 37-building Veterans' Hospital



TICOTHERM STEAM GENERATORS

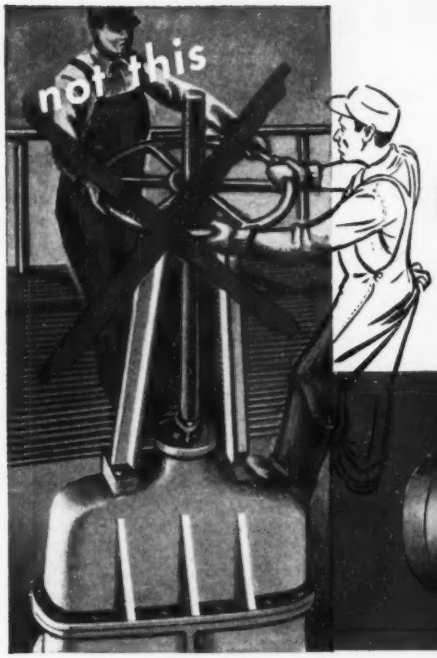
This battery of four Ticotherm Steam Generators dependably and economically serves the power and heat requirements of the 2000-patient Franklin Delano Roosevelt Veterans' Administration Hospital at Peekskill, New York. Ticotherm Steam Generators are always your sound choice for maximum steam output at lowest operating cost. *Write for details!*

THE TITUSVILLE IRON WORKS COMPANY

A division of Struthers Wells — Representatives in Principal Cities

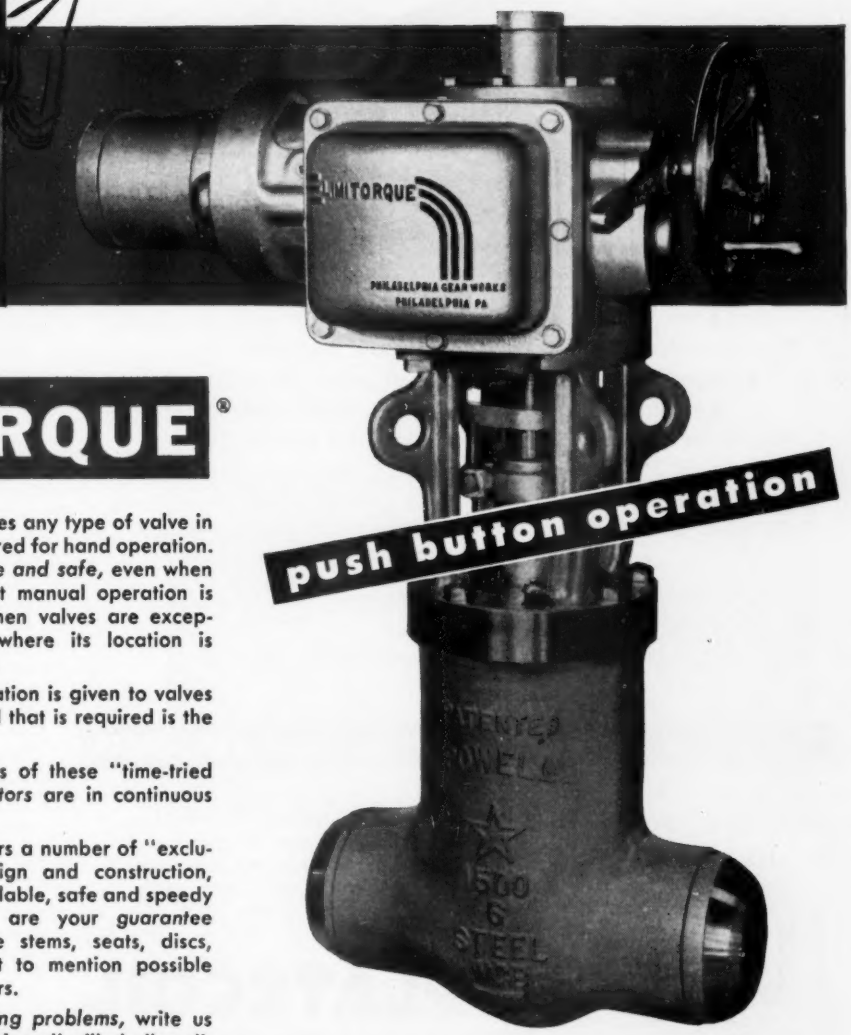
TITUSVILLE, PENNSYLVANIA

Manufacturers of A COMPLETE LINE OF BOILERS FOR EVERY HEATING AND POWER REQUIREMENT



Pushing a Button

is SAFER EASIER QUICKER



LIMITORQUE®

push button operation

LimiTorque opens and closes any type of valve in a fraction of the time required for hand operation. It is *absolutely dependable and safe,* even when pressures are so *high* that manual operation is almost impossible . . . when valves are exceptionally *hot* . . . and where its location is *hazardous* or *inaccessible.*

Yes, instant, positive operation is given to valves located miles away . . . all that is required is the push of a button.

Thousands upon thousands of these "time-tried and tested" *Valve Operators* are in continuous use, all over the world.

Of course, *LimiTorque* offers a number of "exclusive advantages" in design and construction, which not only give dependable, safe and speedy performance, but which are your *guarantee* against damage to valve stems, seats, discs, plugs, or gates . . . not to mention possible physical injury to operators.

If you have *valve operating problems,* write us —and a "Philadelphia Engineer" will gladly call.

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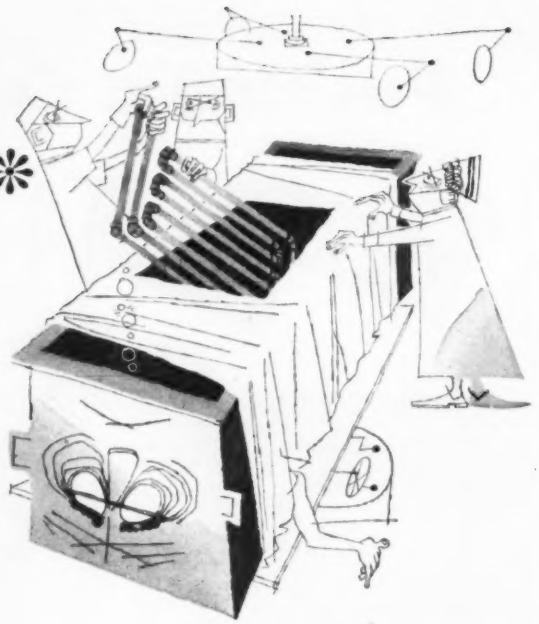
Industrial Gears and Speed Reducers
LimiTorque Valve Controls

has

coil-itis

got you constantly doctoring your tanks?



Like the human appendix, pipe coils often give constant trouble until they are removed and replaced with Platecoils. Immediately, you will notice the difference as Platecoils put new life and profits into your heat transfer processes. They heat or cool 50% faster. They take 50% less space in the tank leaving room for greater payload. Platecoils overcome the limitations and operating difficulties of old fashioned and outmoded pipe coils to save hours of downtime.

It costs less to cure coil-itis with Platecoils than to suffer its evils.

Write for Bulletin P79 today!

PLATECOILS SAVE 50% IN HEAT TRANSFER COSTS

PLATECOILS REQUIRE 90% LESS CLEANING

At Motor Wheel Corporation cleaning time has been cut from 10 hours per pipe coil every 60 days to only one hour per Platecoil. Ask about other case histories.

PLATECOIL

REPLACES PIPE COILS

Coil-itis — Diagnosed as tank heating and cooling problems. Platecoils — the prescription for solving pipe coil problems.

PLATECOIL DIVISION, KOLD-HOLD MANUFACTURING CO., LANSING 4, MICHIGAN

More POWER NEWS

Begins on page 154

Advances in Synthetic Fuels

Important technical advances in producing synthetic liquid fuels from coal and oil shale plus recommendation that further prototype commercial plants be started highlight the Bureau of Mines 1952 report to Congress.

Progress described in the report includes: (1) advances in oil shale technology with completion of a 200-ton-per-day oil-shale retort using the Bureau developed gas-combustion process; (2) successful operation of a pilot plant for retorting oil-shale fines at high temperature to produce high test gasoline and chemicals; (3) experiments in gasification—an important step in producing oil from coal; (4) advancing underground gasification to the point where gas suitable for making synthetic fuels, pipeline gas or chemicals can be made; (5) progress in coal hydrogeneration; (6) gas-synthesis research.

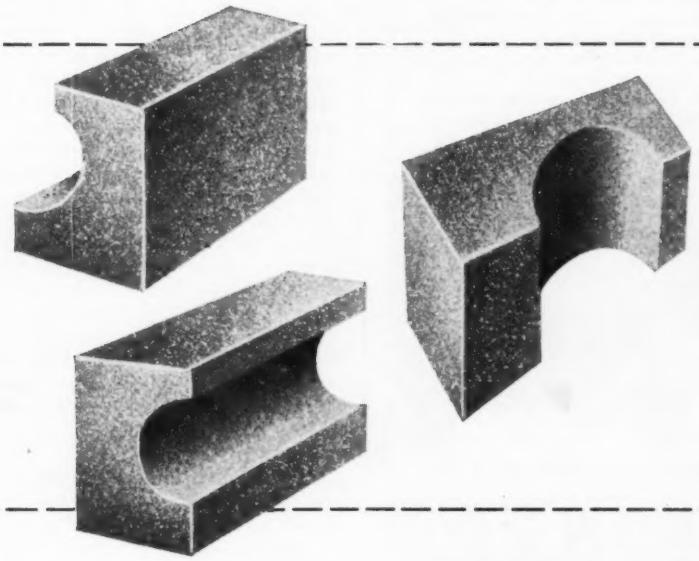
Many of the projects in this field are done under cooperative agreement between the Bureau of Mines and private industry, educational institutions, individuals and other Government agencies.

The **Society of Automotive Engineers** and the **American Society of Mechanical Engineers** as administrative sponsors for Sectional Committee B1 announce that the American Standard Acme Screw Threads, B1.5—1952, and American Standard Stub Acme Screw Threads, B1.8—1952 were approved as American Standards on May 7. Copies of these standards may be obtained from ASME, 29 W 39th St, New York 18, N.Y.

Melbourne—(McGraw-Hill World News)—Australia will soon have an Atomic Energy Commission based on the U. S. AEC. Australia's chief interest is in using atomic energy to produce electric power which is scarce and expensive in several Australian States.

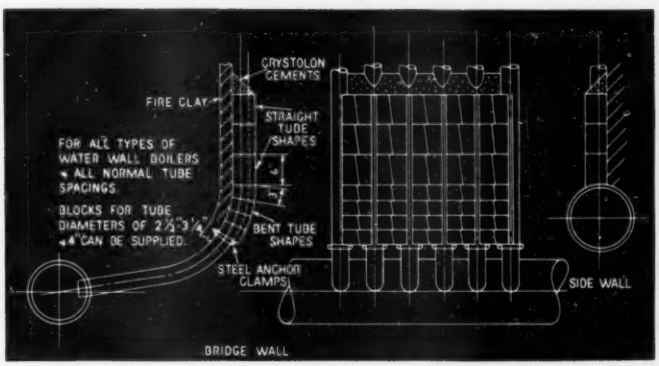
A third biennial briquetting conference will be held on August 31 and September 1 at Banff Springs Hotel in the Canadian Rockies. The briquetting industry of the United States and Canada together with the Natural Resources Research Institute of the University of Wyoming are developing an outstanding program of papers and plant visits to some of Western Canada's new and modern drying and briquetting plants. Interested persons and companies are urged to contact Neal Rice, Coal Research Chemist at the Natural Resources Institute, University of Wyoming, Laramie, Wyoming.

LASTING, LOW-COST PROTECTION
for Your Water Tube Boilers
with CRYSTOLON* Armor Blocks



Made Of Top-Quality Silicon Carbide, Norton CRYSTOLON Armor Blocks have the necessary refractoriness to withstand today's extremely high boiler furnace temperatures. Equally important is their high resistance to slag penetration and abrasion. Due to their high thermal conductivity, they promote even heat distribution, and afford maximum protection to tubes from localized heat generation and flame impingement.

Installation Is Easy And Inexpensive, thanks to the simplified design of CRYSTOLON Armor Blocks. Adjoining surfaces of blocks are tapered, for secure locking and to maintain intimate contact with the tubes. Available for both bent and straight tube sections, these blocks can be replaced entirely from the fire side of the boiler. They are laid dry, further reducing installation costs, and tubes require no cleaning or grinding, as when cast iron blocks are replaced. When small areas are to be protected against flame impingement, blocks can be held correctly in place by clamps fitted around the tubes.


CRYSTOLON CEMENTS
FIRE CLAY
STRAIGHT TUBE SHAPES
FOR ALL TYPES OF WATER WALL BOILERS & ALL NORMAL TUBE SPACINGS.
BLOCKS FOR TUBE DIAMETERS OF 2½-3¼" & 4" CAN BE SUPPLIED.
BENT TUBE SHAPES
STEEL ANCHOR CLAMPS
SIDE WALL
BRIDGE WALL

Whatever type or make of water tube boilers you're using, you can depend on CRYSTOLON Armor Blocks for thorough protection and economy. For prices and full information, send data on tube diameters, tube spacing, radius of curvature in bent-tube sections, and dimensions of areas to be covered. Refractories Division, NORTON COMPANY, 444 New Bond Street, Worcester 6, Mass.

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

NORTON

Special REFRACTORIES

Making better products to make other products better

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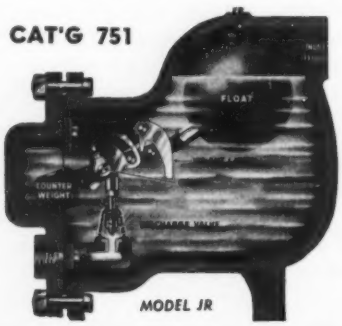
NICHOLSON WEIGHT-OPERATED TRAPS

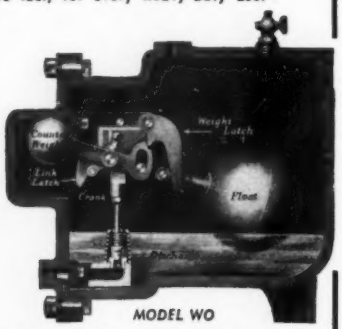
NEVER NEED PRIME

Nicholson weight-operated traps, under no condition, leak live steam. This prevents the costly loss of steam occurring when bucket traps lose their prime as a result of drying up in superheat or flashing at sudden pressure drops. Under these conditions Nicholson weight-operated traps still hold tight because they do not depend on buoyancy of float to raise valve. For purifiers, super-heated lines, headers, separators, heaters, dry kilns, pipe coils, turbine throttle valve drips, stop and check valves, etc. Also for air and gasoline. 3 Types—press. to 200, 500 and 1500 lbs.; for every heavy-duty use.

CAT'G 751



MODEL JR



MODEL WO

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W. H. NICHOLSON & CO.

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...the Packing that PACKS ALL

Costs less because it lasts longer

The tougher the job the more convincing the proof that ALLPAX is the packing for economical service under the most exacting conditions. And this bettr, lower cost service is assured without ALLPAX losing its resiliency or having to be subjected to excess pressures in stuffing boxes . . . and, of course, without the slightest chance of scoring rods.

You can use ALLPAX for all classes of service . . . against steam, vapor, air, ammonia, oils, gases, etc. for temperatures up to 600°. Special types are available for higher temperatures, corrosive liquid, food products, etc.

ALLPAX is furnished in all types of rings, mandrel or die-molded, butt or mitre joints . . . for all sizes of stuffing boxes, in single or set form for all services. It is also available in loose form.

Send for catalog describing the complete line . . . also ALLPAX GASKET CUTTERS. Consult your nearest distributor or us direct.

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805 Mamaroneck Ave., Mamaroneck, N.Y.

Superheat Sheet Packing . . . Oil Proof Sheet Packing . . . Red Rubber Sheet Packing . . . Diaphragm Sheet Packing . . . Cloth Inserted Sheet Packing

More TECHNICAL BRIEFS

Begins on page 156

facture, the outside of the magnet was centerless ground and was located by fitting into a rabbet on the fingers of the flux collecting poles. This did have a tendency, however, to have a high shaft leakage which reduced the output voltage. But the leakage was reduced by using a layer of non-magnetic material such as brass between the inside sleeve and used to hold the two finger mechanisms together around the castings. These changes resulted in about 70% reduction in the amount of alnico casting on the large diameter rotor and somewhat lower reduction on the small diameter rotor. The leakage between the fingers of this type of construction, with the rotor removed from the stator, was high enough that the minor loop on the demagnetization curve after re-assembly was much higher than the previous design. This was part of the reason of the large amount of reduction in alnico weight. *AIEE Paper No. 53-153.*

Under Excited Operation of Large Turbine Generators on Pacific Gas and Electric Co's System. *By V F Estcourt and W R Johnson, Pacific Gas & Electric Co; C H Holley and P H Light, General Electric Co.*

Power factor on the Pacific Gas & Electric Co's transmission system has increased because of the growth of high-voltage lines and increased use of capacitors. These conditions tend to increase system voltage, particularly during light loads, and make regulation by under-exciting turbine-generators important. During May 1951, 83 tests were conducted at the company's Moss Landing steam plant on two hydrogen-cooled 3600-rpm units, one rated 115,000, and the other 129,375 kva at 15 psig hydrogen pressure. These tests were conducted jointly with the General Electric Co to determine limits of operation in the leading-power-factor range and establish a basis for safe operation under these conditions, with particular attention to heating of the end iron of the stator core. Conclusions arrived at are:

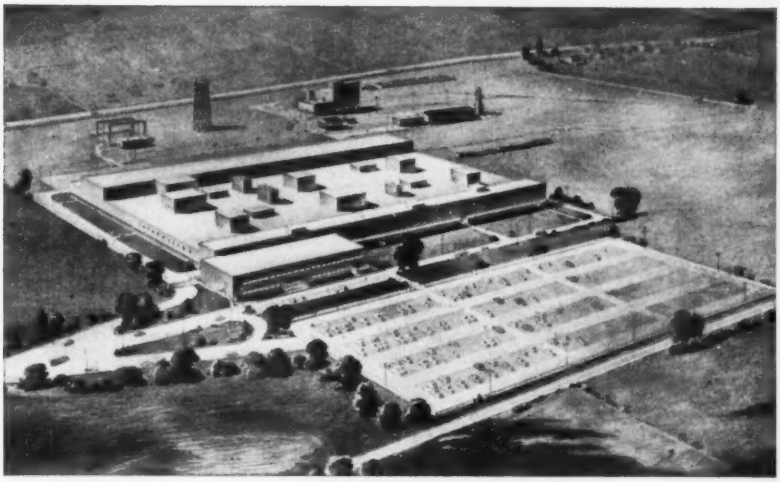
1. These tests confirm that the generators can operate continuously at 0.95 leading power factor with rated kva and rated voltage without danger in heating of the stator core iron.

2. Heating of the stator-core end punching responds very quickly to changes in load and excitation.

3. Operation of Unit No. 2 at 0.86 power factor leading, 82.9 mva at 13.1 kv, and 15 psig hydrogen with the rotating amplifier voltage regulator in

Directions for ordering papers on p 158

TWO WICKES STEAM GENERATORS will help heat the CATERPILLAR TRACTOR CO.'s new plant at York, Pa.



CONTRACTORS: Consolidated Engineering Company Inc., Baltimore, Md.
CONSULTING ENGINEERS: Whitman, Requardt & Associates, Baltimore, Md.

The Caterpillar Tractor Co., one of the world's largest manufacturers of earth moving equipment, will shortly open their new York, Pa. plant where several hundred men will turn out track assemblies for world famous Caterpillar D6, D7 and D8 Tractors. In this modern manufacturing facility, Caterpillar has installed two 80,000 lb. WICKES steam generators to obtain efficient, economical heat throughout the 360,000 sq. ft. structure. These Type R 2-drum WICKES boilers have a design pressure of 200 psi. and are equipped with economizers and spreader stokers. WICKES can fill your requirements for steam generators up to 250,000 lbs. per hour and 1000 psi. – all types of multiple drum boilers, adaptable to any standard method of firing: oil, gas, underfeed or spreader stoker. Consult your nearest WICKES representative or write us today for descriptive literature.

145

WICKES

THE WICKES BOILER CO., SAGINAW, MICHIGAN • DIVISION OF THE WICKES CORPORATION

RECOGNIZED QUALITY SINCE 1854 • SALES OFFICES: Atlanta • Boston • Buffalo • Chicago • Cincinnati • Cleveland • Denver • Greensboro, N.C. Houston • Indianapolis • Los Angeles • Memphis • Milwaukee • New York City • Pittsburgh • Portland, Ore. • Saginaw • Springfield, Ill. • Tampa Tulsa • Washington, D. C.

NATIONAL AIROIL

"S-A"

TYPE STEAM ATOMIZING OIL BURNER

VIRTUALLY IMPOSSIBLE FOR ANYTHING TO CLOG OR GO WRONG . . .

. . . SEE FOR YOURSELF!

The popular NATIONAL AIROIL Steam Atomizing Oil Burner *thoroughly atomizes* and *completely burns* the lowest and cheapest grades of fuel oil or tar . . . requires only minimum supervision and maintenance. Only slight oil pressure and temperature is needed . . . and internal atomizing venturi feature assures low steam consumption . . . usually as little as 1%! NATIONAL AIROIL Type "SA" Oil Burner is adaptable to all types of industrial heating, power or process furnaces . . . is suitable for firing above stoker grates on conversion to oil.

Other "SA" modifications designed for: the burning of Colloidal fuel ("SAR")—Large capacity operation ("SAL") — Sludge burning ("SAD") — Combined steam and mechanical atomization (Dual Stage).

WRITE FOR BULLETIN 21

OIL BURNERS and GAS BURNERS for industrial power, process and heating purposes
STEAM ATOMIZING OIL BURNERS
MOTOR-DRIVEN ROTARY OIL BURNERS
MECHANICAL PRESSURE ATOMIZING OIL BURNERS
LOW AIR PRESSURE OIL BURNERS
AUTOMATIC OIL BURNERS, for small process furnaces and heating plants
GAS BURNERS
COMBINATION GAS & OIL BURNERS
FUEL OIL HEATERS
FUEL OIL PUMPING and HEATING UNITS
FURNACE RELIEF DOORS
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SPECIAL REFRACTORY SHAPES

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INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT

More TECHNICAL BRIEFS

Begins on page 156

service shows that the machine was stable and a moderate temperature rise was obtained on the end of the stator core.

4. In the under-excited region operation at 95% rated terminal voltage requires a decrease of approximately 5% or more in kva to maintain constant end-iron temperature.

5. In the range of 0.5 to 15 psig, the tests confirmed that increased hydrogen pressure is equally as effective in limiting end-iron heating as it is in cooling the rest of the machine.

6. The use of modern continuous-acting voltage regulator will permit operation in the dynamic region and appreciably extends the steady-state stability limit.

7. A minimum field-excitation limit in the voltage regulator prevents reducing the field excitation to unsafe values either from the standpoint of stability or end-iron heating. Additional alarms and instruments may also be used as an added precaution against excessive end-iron heating.

8. Since virtually no increased investment in the generator plant is required, under-excited kilovars at the generating station is an economical attractive arrangement to meet the conditions on the Pacific Gas & Electric Co system. *AIEE Paper No. 53-30.*

Turbine Generator Rotor Heating. *By M D Ross and E I King Westinghouse Electric Corp.*

During the past two years, an investigation has been made to establish the allowable duration of single phase short circuits in turbine generators. Tests carried out on an 11500 kw, 3600 rpm generator are reported here. A method of calculating hot spot temperatures on the rotor wedges is also given in the paper.

Any condition of unbalanced stator currents, such as caused by a line to line or line to ground short circuit, will produce a pulsating magnetic field in the generator which can be resolved into two rotating fields, one rotating in synchronism with the rotor and the other field rotating backward at the same speed as the forward rotating field. The second, or backward, rotating field cuts the rotor at twice normal frequency, generating currents in the rotor surface. The component of armature current which produces the backward rotating field is defined as the negative phase sequence current while that associated with the forward rotating field is called the positive phase sequence

Directions for ordering papers on p 158

SARCO electric temperature control

ACCURACY AND SENSITIVITY BY SIMPLE ELECTRICAL MEANS

"Very successful in our operation, and I specify them on all our new equipment," says Thomas Allison, Plant Engineer of Southern Gravure Service, Louisville, Ky. ***(See photo at left)***

IN HIS CASE the operation is plating, an industry in which SARCO electric controls have found wide adoption.

There are many others: For example, dryers in the textile, tanning, food and chemical industries; dyeing and wet finishing processes in textiles; processing, distilling and evaporating in chemical plants.

SARCO's complete line includes also thermostats and solenoid or motor valves for space heating, air conditioning and refrigeration control.

Get the whole story by writing for bulletins 1025 and 1080.

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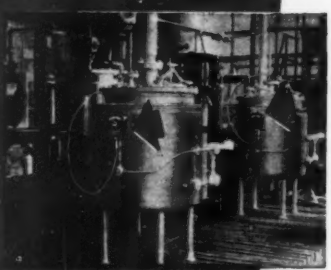
REPRESENTED IN PRINCIPAL CITIES

PLATING

In copper and chromium plating of rotogravure rolls, the temperature of plating solutions is held to within ½°F by Sarco Electric Indicating Temperature Controllers. Photo taken in Southern Gravure Service plant, Louisville, Ky.

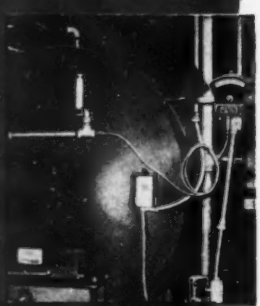
CHEMICAL

Hoffman La Roche Pharmaceutical Co., Nutley, N. J.—the jacket water temperature of these stills must be held to within ½°F. For the past 9 years, Sarco LSI Indicating Temperature Controllers have been doing that job.



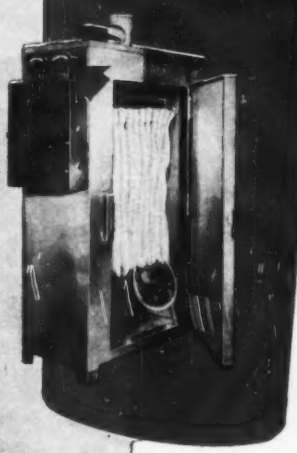
FOOD

Chocolate milk and soft drinks in bottles and cans are processed in Fort Wayne Sterilizers. Many users equip these Sterilizers with Sarco LSI Electric Indicating Controllers to hold the temperature to within ½°F. Hook-up sketches and case histories on request.



TEXTILE

The Backus Hosiery Conditioner processes 15 denier nylon hosiery—40 dozen per 1 hour cycle. The humidity and dry heat are controlled by two Sarco Electric Indicating Temperature Controllers. Over 500 LSI's have been factory-installed on these Conditioners by Backus Machine Works, Carlstadt, N. J.

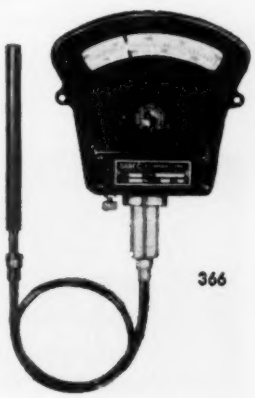


TYPE LSI •

An extremely sensitive and accurate Electric Indicating Temperature Controller for temperatures from minus 90°F to plus 650°F. Controls electric heating elements, motors, solenoid or motor valves to maintain constant temperature.

A built-in thermometer makes setting easy and provides a continuous check on temperatures maintained without the bother of continually changing charts.

A double switch type L2SI is available for alternate heating and cooling control, or step control of heating or cooling.



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When You Think of

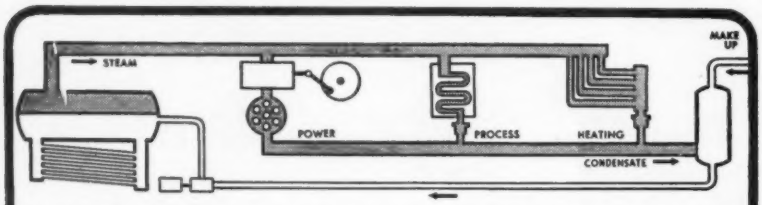
CORROSION PROTECTION for your STEAM SYSTEM

Think of

CORAVOL

(The Original* AMINE PROCESS)

Because CORAVOL Circulates to Control Corrosion



The CORAVOL ZONE—indicated by the shaded area in the diagram—includes every part of a steam system not accessible to boiler feed water treatment. It includes the boiler above the water line, steam lines, condensate return lines, radiators, valves, traps and equipment. This zone can now be reached and protected against rust and corrosive action—by CORAVOL.

CORAVOL IS PART OF A COMPLETE TECHNICAL SERVICE which provides special chemical formulas for . . . boiler feed water . . . foam prevention . . . hot water supply . . . refrigerating brine . . . cooling and condenser water . . . rapid scale removal . . . coagulation . . . algae control . . . fuel oil supply . . . soot removal.

CORAVOL circulating throughout your steam system protects it from corrosive attack. **CORAVOL** saves costly pipe repairs and replacements—maintenance labor—hours and days of shutdown loss. **CORAVOL** cleans out clogging rust deposits, improving heat transfer, restoring original capacity of lines and efficiency of valves and traps.

CORAVOL, the original* amine process, has the flexibility that lets it conform to each individual need. The **CORAVOL** you will use is formulated to do the best protective job under your own plant conditions.

*The use of **CORAVOL** in steam systems is covered by U. S. Patent No. 2053024. The Western Chemical Co., owner of this patent, grants licenses under which volatile AMINES purchased from other sources may be used in steam systems upon payment of royalty to Western Chemical Co.

Chemical Water Treatment

WESTERN CHEMICAL COMPANY

713 Washington Street
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MAIL COUPON TODAY for
Complete Data about the CORAVOL Process

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Send me full information about CORAVOL.

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More TECHNICAL BRIEFS

Begins on page 156

current. The losses and heating caused by the negative phase sequence currents will be discussed here.

The more severe fault so far as rotor heating is concerned is likely to be a line to line fault. The heat input for a line to ground fault with the fault current limited to the three phase value by a suitable grounding resistor or reactor is less than for a line to line fault. While the line to neutral fault draws a somewhat larger current, only half as many armature conductors are involved as compared with a line to line fault.

This work was carried on in connection with a subcommittee of the ASA-C50 Standards Committee Rotating Machinery which was revising the rules in regard to allowable short circuit conditions for alternating current machines. The committee evolved a new criterion for evaluating single phase rotor heating which is described in the paper. *AIEE Paper No. 53-97.*

Power Distribution

Load-Dropping Tests on a Large Ignitron Rectifier. *By S J Pope, Kaiser Aluminum & Chemical Corp; J K Dillard and C R Marcum, Westinghouse Electric Corp.*

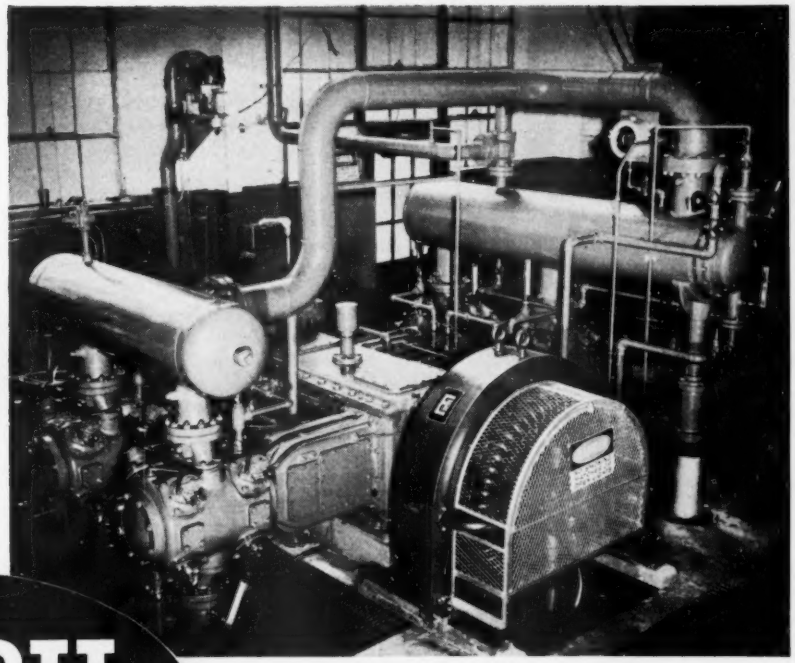
A series of load-dropping tests on ignitron rectifier circuits was conducted during March 1952 on an aluminum potline at the Mead Washington Works of the Kaiser Aluminum & Chemical Corp. The purpose of these tests was to get fundamental data on current and voltage surges in a large ignitron rectifier installation when the potline load was tripped off. These data were needed to determine the best operating procedure for dropping potline loads in higher-capacity ignitron installations. In addition, they were to establish if measures should be taken to protect existing installations against equipment failure from switching surges. The findings were:

1. The best method of dropping load is by ac circuit breaker operation with auxiliary power maintained. Using this method, no serious transient disturbances were observed in either secondary phase or cathode currents. Tripping the primary power supply removed any tendency to unbalance currents between parallel rectifiers, and the current in the transformer secondary was confined to two windings 180 deg out of phase.

2. Load interruption by tripping the ac circuit breaker and auxiliary power simultaneously is satisfactory at Mead.

Directions for ordering papers on p 158

THE IDEAL DRIVE FOR GAS COMPRESSORS

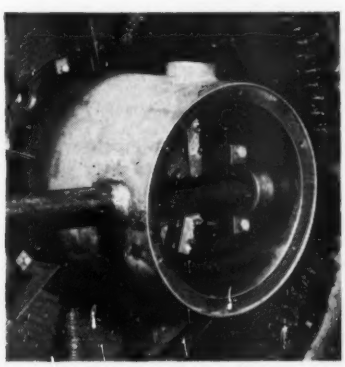


ELLIOTT *Synchronous* MOTORS

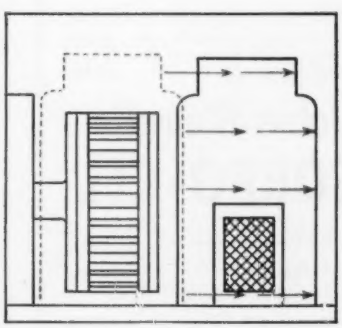
This Elliott synchronous motor drives a Clark CMA-4 compressor. It is featured by the rigidity and strength of its Elliott "Fabri-Steel" construction in frame and stator core plus a number of unique design and construction advantages.

ONE OF MANY REASONS FOR ELLIOTT RELIABILITY
Starting winding bars are SILVER-BRAZED to heavy end ring segments, insuring a permanent, high strength joint, with highest electrical and thermal conductivity. Photo illustrates how an assembly jig is used during silver-brazing to guarantee accurate alignment of parts.

Long-wearing steel collector rings are completely enclosed and pressure ventilated with uncontaminated air. A transparent removable window permits inspection or quick replacement of brushes.



The overhung motor rotor reduces space requirements, eliminates need of an outboard bearing, and increases efficiency. Inspection of the entire stator core and field poles is simple, since the frame can be shifted along its foundation to clear the rotor.



ELLIOTT Company R2-1

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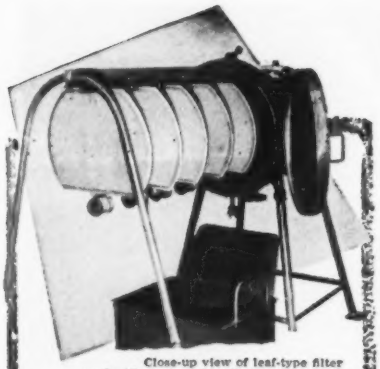

Close-up view of leaf-type filter used with Sorbo-Cel by Pullman-Standard

How Pullman-Standard operates boilers on a

1% blow-down basis...

with SORBO-CEL

At the Haskell & Barker plant of Pullman-Standard Car Mfg. Co., Sorbo-Cel solved the major filtration problem of removing oil from condensate returned to the two new 50,000 lb-per-hr 400 psi, 750-F boilers.

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More TECHNICAL BRIEFS

Begins on page 156

Observed transient in phase and cathode currents were not dangerously high, but proved more severe than when auxiliary power was maintained while load was dropped, leading to the conclusion that provision should be made in proposed higher-capacity installations to maintain auxiliary power. However, the tests showed there is no cause for concern in cases of power failure in which the auxiliary power supply would be lost.

3. Load interruptions by short-circuiting the firing circuit should not be considered in large rectifier installations because of excessive overcurrent and accompanying arc-back.

4. Load interruption by operation of cathode circuit breakers is not recommended because the last breaker has to clear as much as one half the normal potline current.

5. At Mead, it is satisfactory to pick up load by removing the short circuit on the firing circuits, followed by closing the ac circuit breaker. In general, it is recommended that loads be picked up by removing the short circuit on the igniter circuit after the ac circuit breaker is closed. Such procedure reduces the maximum transient current on the ac system since load current does not flow simultaneously with transformer inrush current.

6. The order of magnitude of inductance on aluminum potlines is less than one millihenry. This figure, originally arrived at by calculation, was confirmed by these tests.

7. It is improbable that failures of rectifier transformers on earlier installations were caused by voltage surges resulting from circuit-breaker operations. *AIEE Paper No. 53-65.*

Capacitors in Power Systems with Rectifier Loads. *By A Schmidt, Jr, General Electric Co.*

Static capacitors have come into wide use as an efficient and economical source of reactive power for ac systems. Harmonic voltages are sometimes a problem when applying capacitors to a system. In early days the principal sources of system harmonics were rotating machines and transformers. More recently, the widespread application of mercury-arc rectifiers has introduced other sources of system harmonics. These often require consideration when rectifiers and capacitors are connected to the same system.

Parallel-type resonance between capacitors and system reactance in the presence of harmonic sources, such as power rectifiers, may cause: (1) Over-

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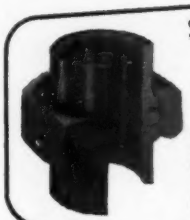

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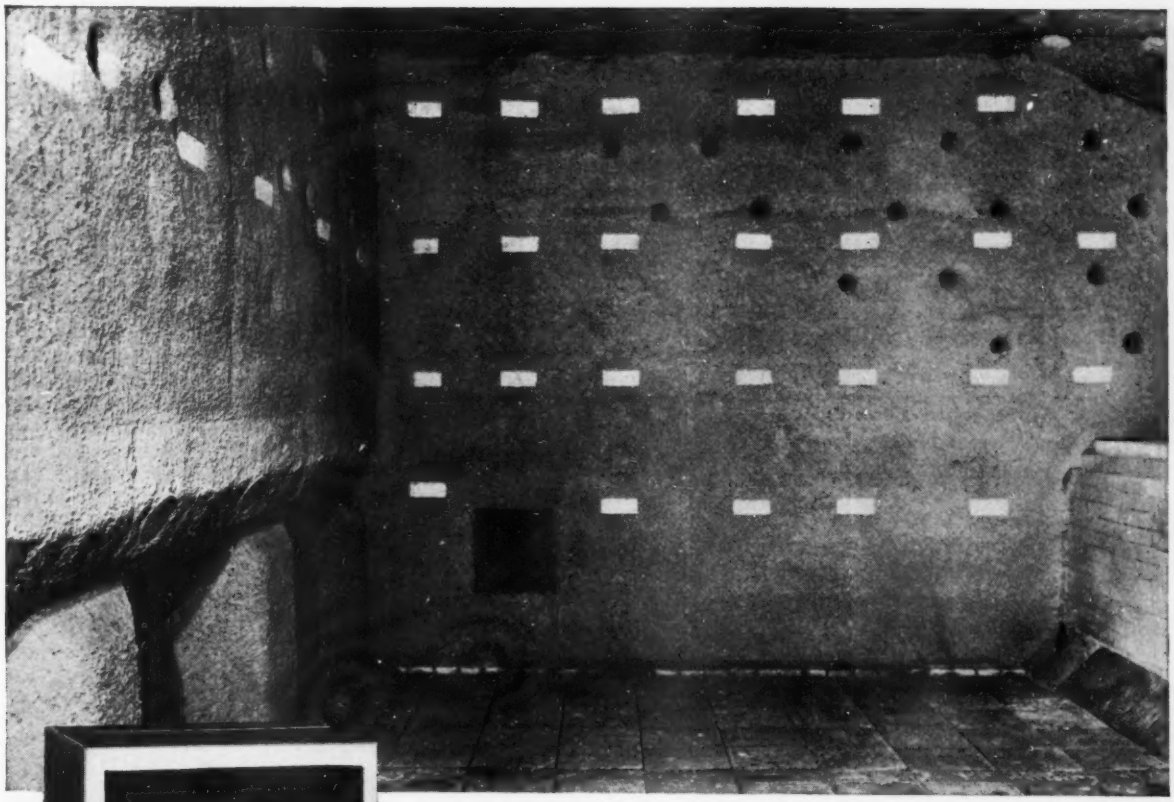

A. P. Green SUPER-PLASTIC refractory lining in large coal drier furnace. SUPER-PLASTIC is a super duty plastic firebrick for use in zones where conditions are most severe. A. P. Green monolithic linings of this type are joint-free, highly resistant to spalling and slag attack, and provide an airtight, securely anchored unit that gives greatly increased service life.

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...ELECTRICAL INSULATION RESISTANCE

Reconditioning Wet Apparatus

The bad effects of excessive moisture in insulating material, particularly when localized, are numerous. The effect most likely to result in failure in the early stages of exposure is that of low resistance paths which may develop either through or over the surface of the insulation. The likelihood of failure from this cause is increased by the presence of dirt and other foreign matter, and may occur in either organic or inorganic insulating material.

If moisture has been deposited on clean insulation only superficially, then the heat resulting from the normal operating temperature of the equipment may remove it before failure occurs. However, the normal operating heat of at least some parts of the equipment is sometimes insufficient to drive out moisture that has penetrated through surface defects.

If moisture is allowed to remain in insulation, it usually—in time—causes corrosion of metal conducting parts, aggravated by the presence of chemicals and electric potential, thus increasing the danger of failure.

In addition to apparatus which may be exposed to moist atmosphere, or wet with fresh water, there may be occasions when it becomes necessary to rehabilitate equipment that has been subjected to salt water. In such case, clean fresh water must be used to remove all traces of salt before drying of the apparatus is attempted. Any evidence of oil or grease on the insulation should also be removed by using a volatile solvent such as carbon tetrachloride.

Then the apparatus must be dried out before electrical potential is applied. Numerous methods and various temperatures for drying out electrical equipment are used, including forced hot air, ovens, circulating electric current through the conductors, or combinations of these methods. Local conditions and facilities, manufacturer's recommendations, and the type of equipment involved, dictate the method used.

Test Procedure

If possible, secure records of previous insulation resistance tests on the apparatus.

Make short-time tests and time-resistance tests for comparison to help decide whether drying is necessary. If present readings are at all comparable with previous tests made at or corrected to the same temperature, a drying-out run *may* not be necessary.

NOTE: *The above material is taken from our Instruction Manual—for the use of Megger Insulation Testers. Within its 96 pages, such subjects as "Temperature Correction", "Interpretation" and many others are discussed in a clear and interesting manner with very ample illustrations, charts and tables. We'll be glad to send you a copy of this manual without obligation. Just write on your company letterhead for* ***Manual 21-J- P***

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Begins on page 156

loading of capacitors, particularly if installed kvar is much in excess of one-third of 1% of system short-circuit kva. (2) Operation of capacitor overcurrent protective devices. (3) Telephone interference. These conditions can be remedied by connecting suitable reactors in series with the capacitors when the voltage rating of the capacitors is not exceeded by so doing.

The presence of harmonic voltage will cause unbalanced load upon the rectifiers. This in turn will increase the low-frequency harmonic current in the system, so that a cumulative effect is produced with large resultant unbalance in load. This can be overcome by the use of phase retarders on some of the rectifier, which is objectionable because of increased commutating duty on the rectifiers. Tuning of the capacitors to a suitable frequency would limit the harmonic voltage and reduce unbalance. *AIEE Paper No. 53-24.*

Industrial Electronic Rectifiers for Essential Service. *By M E Reagan, Westinghouse Electric Corp.*

Essential service loads are found in hospitals, department stores, office buildings, hotels, apartment buildings, and other public centers where total power interruption may mean panic and possible loss of life. Some industrial processes are also included in essential service classification. They vary somewhat in degree and some of them may permit short-time interruptions, while longer outages may prove expensive. All sizes of rectifiers, sealed and pump type, must therefore be considered.

Direct-current power supply still offers the best means for speed control applications. The same is true of electrolytic processes where unidirectional current is necessary. Since today's practice indicates the power rectifier as the best source of direct current, this paper is confined to the various types of troubles and protective systems which tend to interrupt service in single-unit and multi-unit rectifier stations. *AIEE Paper No. 53-66.*

Magnetic Amplifier Applications in Dc Conversion Stations. *By W A Derr and E J Cham, Westinghouse Electric Corp.*

Recent developments with magnetic materials and metallic rectifiers make possible the manufacture of magnetic amplifiers which have essentially linear transfer curves and which are essentially independent of changes in load resistance and supply voltage over a

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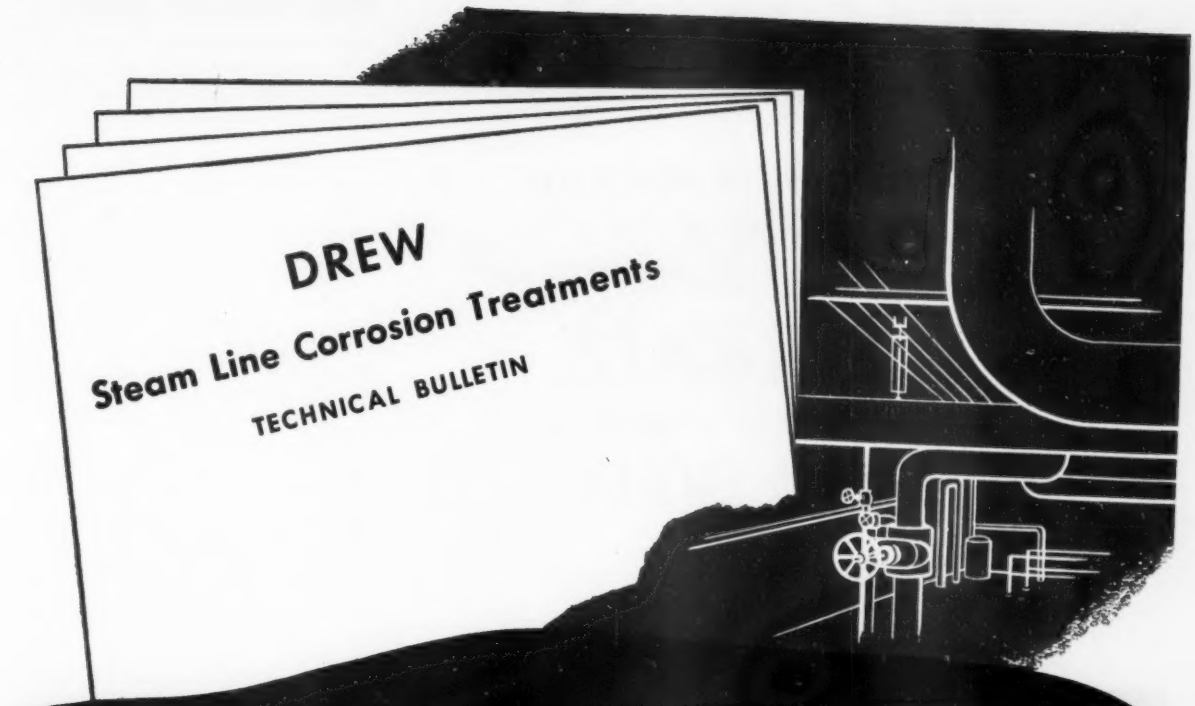

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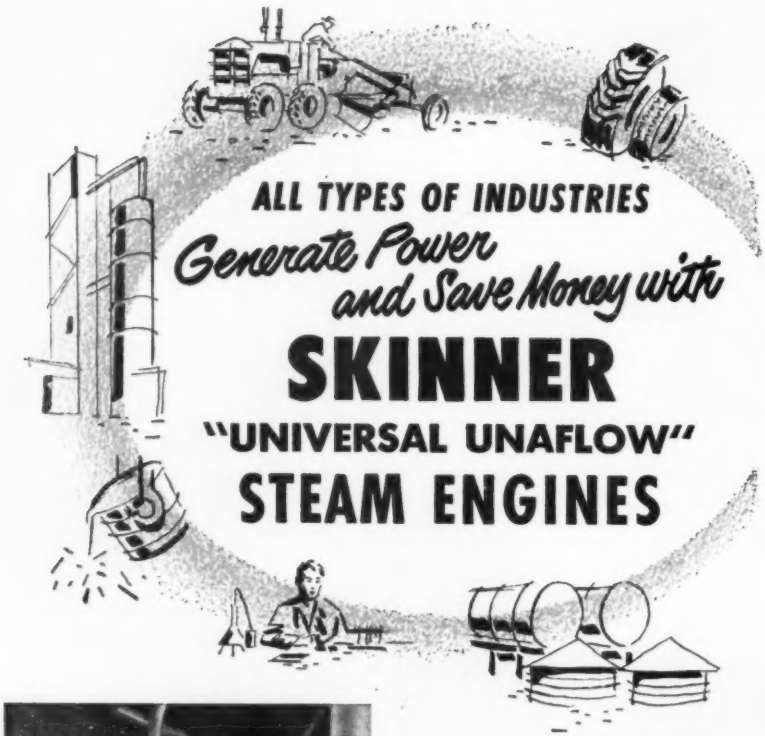

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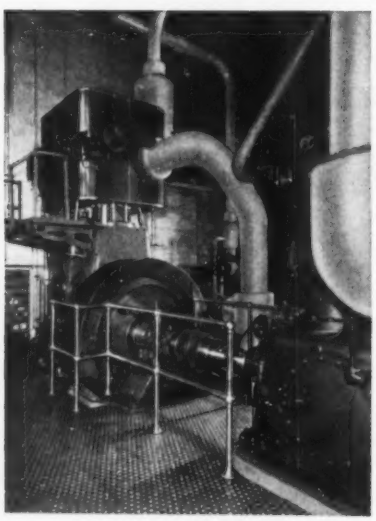
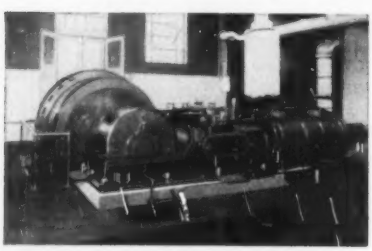


Two-cylinder "Universal Unaflow" driving ammonia compressor, in Brewery Power Plant.



300-Kilowatt Horizonal "Universal Unaflow" in Meat Packing Plant.

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Begins on page 156

wide range. With these desirable features, magnetic amplifiers can be applied in dc conversion stations to provide complete isolation and adequate insulation for high dc voltages for instrumentation, protection and control circuits. In addition, the isolation obtained with magnetic amplifiers simplifies some problems and provides a solution to others of instrumentation, protection, or control. The fact that ac voltage is required for operation of a magnetic amplifier is not a disadvantage in a dc conversion station, since ac voltage is always available.

Some of the simple applications of magnetic amplifiers which have been made in dc conversion stations are given along with some other possible uses. With the great interest which is now shown in the design and application of magnetic amplifiers, it appears certain that there will be many more worthwhile and normal uses in the dc power field. *AIEE Paper No. 53-26.*

Electronic Frequency Changer Tie Between Ac Power Systems. *By Harold Winograd, Allis-Chalmers Mfg Co.*

Early in 1943, a 6,667-kw electronic frequency changer, using mercury arc rectifier, was installed in the Gary Sheet & Tin Mill of the United States Steel Co at Gary, Ind., to provide a non-synchronous tie between the 25-cycle and 60-cycle power systems for the controlled interchange of power in either direction. All the 25-cycle power is generated in the steel company's plant in the Chicago district. The 60-cycle system is supplied by the steel company's generating equipment and by the Northern Indiana Public Service Co.

The interchange had to be made through a non-synchronous tie because of the frequency variations on the 25-cycle system. The electronic type frequency changer was selected by the engineers of the United States Steel Co after investigating several alternative methods, including the Scherbius system, two ac, two dc motor-generator sets, and two rotary converters. Preference was given to the mercury-arc frequency changer, in spite of its higher first cost and the pioneering involved, for the following reasons:

1. It consists of stationary equipment and requires no special foundation.

2. There are no slip rings, commutators and brushes, and the maintenance cost was expected to be lower.

3. It is easy to start without any shock on the system and it requires no synchronizing. It does not feed into a fault

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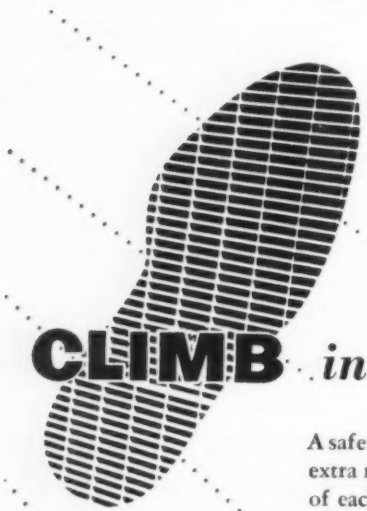

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on the ac system.

4. The power flow can be controlled easily.

5. It has a higher all-day efficiency.

In the original installation multi-anode mercury-arc rectifiers were used. In 1948 these were replaced by single-anode excitron rectifiers, and the rating was increased to 8,000 kw. A second 8,000-kw unit was installed in 1949, bringing the capacity of the installation to 16,000 kw, with a two-hour rating of 20,000 kw.

In the electronic frequency changer a dc link serves as the tie between the two power system. A power rectifier converts power from one ac system to dc power, which is in turn converted to ac power in the other systems by a power converter.

The electronic frequency changer has proved itself as a practical and highly flexible tie between ac power systems. The interchange of power can be controlled easily and accurately, unaffected by frequency and voltage changes. However, its application opportunities are limited. Because of its higher first cost it can be applied economically only where a synchronous-synchronous frequency changer cannot be used, as was the case for the Gary installation.

Besides the Gary installation, the United States Steel Co has an electronic frequency changer operating in a steel mill near Pittsburgh. It is rated at 20,000 kw and uses a different type of rectifier tube and was also installed in 1943. *AIEE Paper No. 53-53.*

Handling Load Regulating Problems On Interconnected Power Systems. *By C Nichols, Leeds & Northrup Co.*

Parallel operation of power systems has developed so extensively in recent years that there are now only six major interconnections in the country and a grid approaching nation-wide extent is not too fantastic a contemplation for the future. Associated with this epansion has been a widespread dependence on telemetering and load control facilities which have proven to be essential for normal operation. Close cooperation with operating engineers over a twenty-five year period has resulted in the progressive development of equipment necessary to cope with the ever-changing load regulating problem. This paper reviews the present techniques used in solving load regulating problems and shows design trends which anticipate the needs of the future.

Present-day operating requirements

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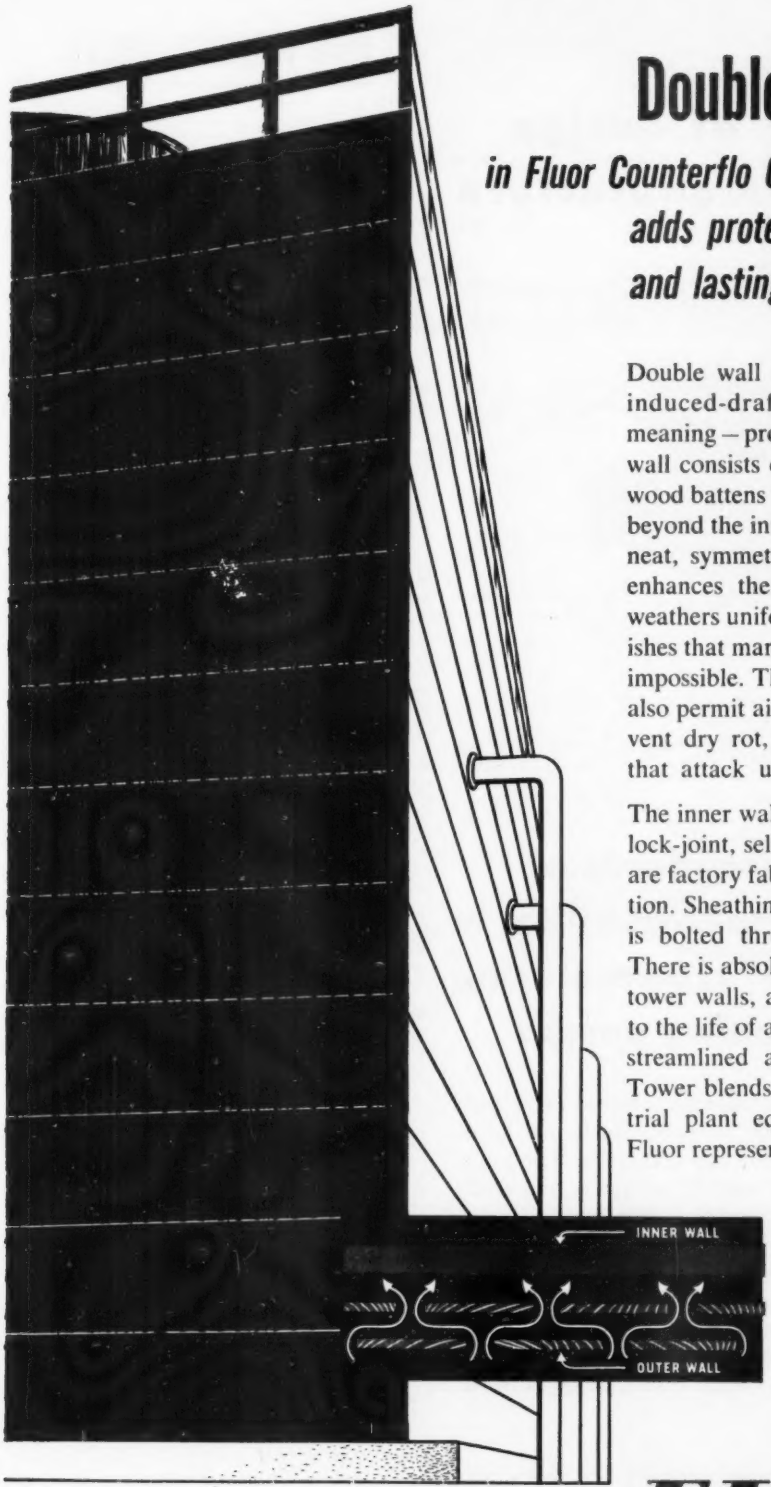

Top view of double wall. The uniform spacing of vertical battens is not for the sake of appearance alone. Air is permitted to circulate between the aerators to prevent dry rot and living organisms from attacking tower walls.

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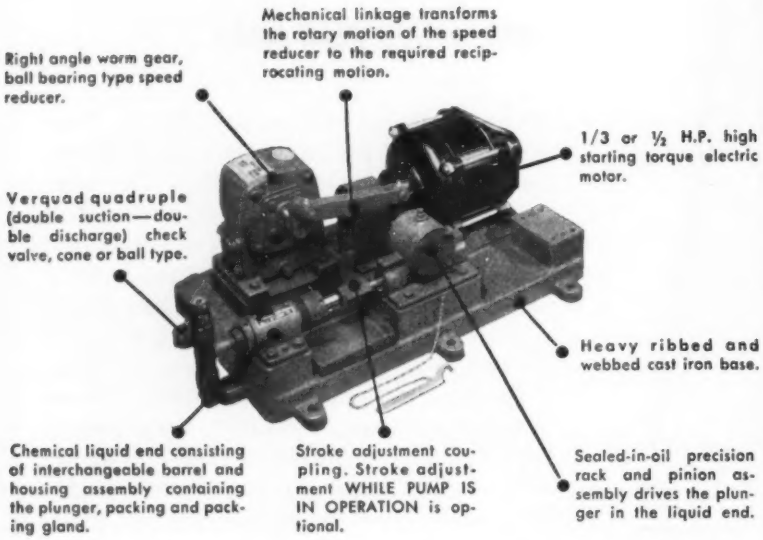
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on these large interconnections have brought two major load regulating problems into sharp focus: 1. Permissible scheduled loading on critical arterial tie lines is being reduced by increasingly large cyclic swings. 2. Appreciable savings are being lost by the inability of operating personnel to maintain the loading on an increasing number of stations and units in accordance with incremental costs.

Past experience has shown that the relative importance of these two problems for any member system of an interconnection varies with operating conditions. In general, systems that cover a large geographical region with long lines to neighboring systems are frequently more concerned with the first problem. On the other hand, systems which supply concentrated metropolitan loads have pursued the solution to the second problem. With the unprecedented load growth now facing the power industry, operating requirements demand that many systems devote equal attention to both problems.

The latest techniques in applying automatic load control have permitted the solution to both these problems on the same system. The author describes an advanced control scheme which enables a given system to install equipment initially to handle its immediate load regulating problem with full assurance that additions can be made to solve the problems of the foreseeable future.

When analyzing the load regulating problem on an operating area of a large interconnection, you divide the customer load changes into two classifications. This paper refers to the fast load fluctuations of a cyclic nature as fringe load changes, whereas the integrated changes which make up the system load curve are designated as sustained load changes.

Since it is now accepted practice to control automatically in response to sustained load changes on most areas of a large interconnection, a basic problem involves the selection of the stations and units that will respond to this control action. The magnitude and rate of change of the sustained load changes together with the cost of generation on the proposed units determines the extent of the automatic control system. The trend is to distribute the generation changes in response to the sustained load changes among a large number of units in several stations in accordance with the most efficient loading schedule.

The possibility of controlling genera-

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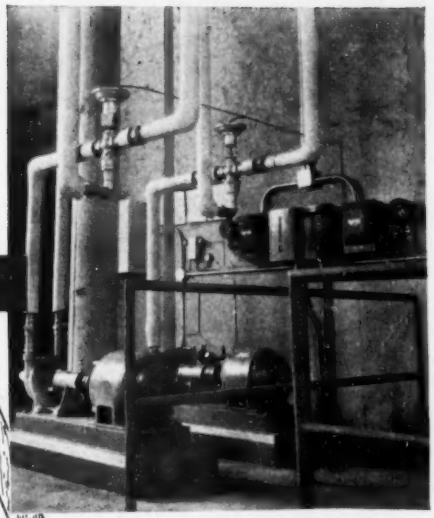
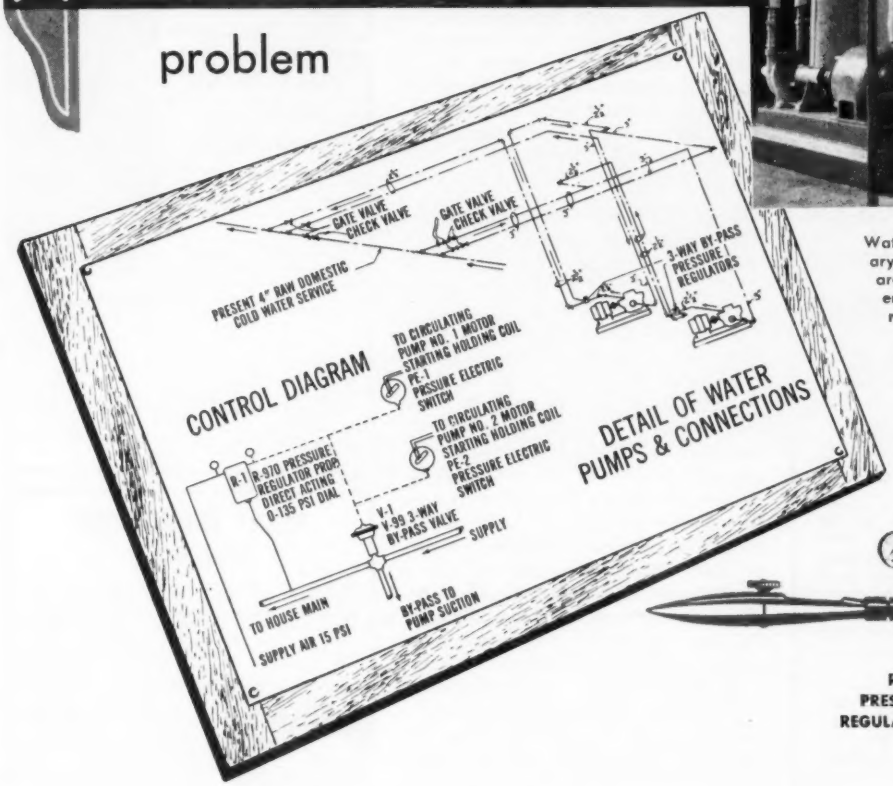


Water Pump Installation, Marillac Seminary, Normandy, Mo. Maguolo & Quick, architects; Harry F. Wilson, mechanical engineer; McNamara Equipment Co., mechanical contractors, all of St. Louis.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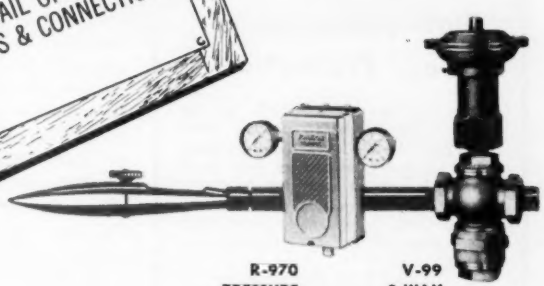
PE-2 PRESSURE ELECTRIC SWITCH
R-1 R-970 PRESSURE REGULATOR PROP DIRECT ACTING 0-135 PSI DIAL
V-1 V-99 3-WAY BY-PASS VALVE
SUPPLY
TO HOUSE MAIN
BY-PASS TO PUMP SUCTION
SUPPLY AIR 15 PSI
DETAIL OF WATER PUMPS & CONNECTIONS



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V-99 3-WAY BY-PASS VALVE

Eliminate inefficient operation and the possibility of complete shut-downs due to low water pressure! The Johnson Control hook-up, shown here, solves the problems.

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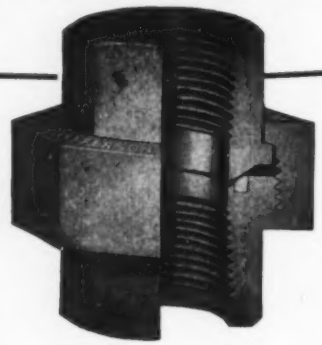

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More TECHNICAL BRIEFS

Begins on page 156

tion automatically in response to fringe changes should be investigated if the fringe load variations limit the maximum scheduled power transfer on the ties to neighboring areas, or if the rate of change of generation in response to sustained load changes approaches the rate of change of the fringe load variations. If it is necessary to control automatically in response to fringe load changes, it is highly desirable from an operating standpoint that the percentage of fringe action assigned to the regulating stations and units be adjustable independently of the percentage of the sustained control action assigned to these stations and units. *AIEE Paper No. 53-147.*

Electric Distribution and Control for Lighting Systems. *By W H Kahler, Westinghouse Electric Corp and R N Bell, E I du Pont de Nemours & Co.*

Higher illumination levels and new lighting sources make it necessary to re-examine possible methods of power distribution and control for lighting loads. As a result of the higher lighting density and versatile lighting sources, the designer must now exercise a considerable amount of engineering judgment in planning a distribution system. New design techniques make it possible to provide maximum convenience and reliability at minimum cost and with a minimum use of critical materials. Some of the requirements of the different lighting sources and modern trends in power distribution and control for lighting loads are discussed and analyzed.

Conclusions are reached that the investment in the distribution system for supplying lighting loads can be considerably reduced by installing a combined power and lighting arrangement in which the lights are supplied directly from the 460-v supply. The reluctance of many individuals to go to voltages higher than 120 for lighting, plus the failure of most distribution engineers to recognize the inherently lower cost and copper savings in this type of system, is apparently responsible for the 460-v supply to lighting load not being more widely used.

The line to neutral connection of the lights on 460-v systems appears to be the most practical method at the present time. Connecting the lights line to line on either 460-v delta or a 460-v grounded wye system is feasible and offers the advantage of slightly lower cost branch circuits from the panel board. However, line-to-line connections of lights make it necessary to use either 2- or 3-pole breakers in the lighting

Directions for ordering papers on p 158

FUELS AND COMBUSTION HANDBOOK

Comprehensive data covering the full range of commercial fuels and their combustion. Gives practical aid in the selection and use of fuels and all types of fuel combustion equipment. Applies rapid computation technique of alignment charts and uses comparative tables to show advantages, disadvantages, average performance, data, etc., of optional equipment and methods. **Edited by A. J. Johnson, Cons. Eng., and G. H. Auth, Villanova Coll. 915 pp., 403 illus., $14.00**

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Position P-5

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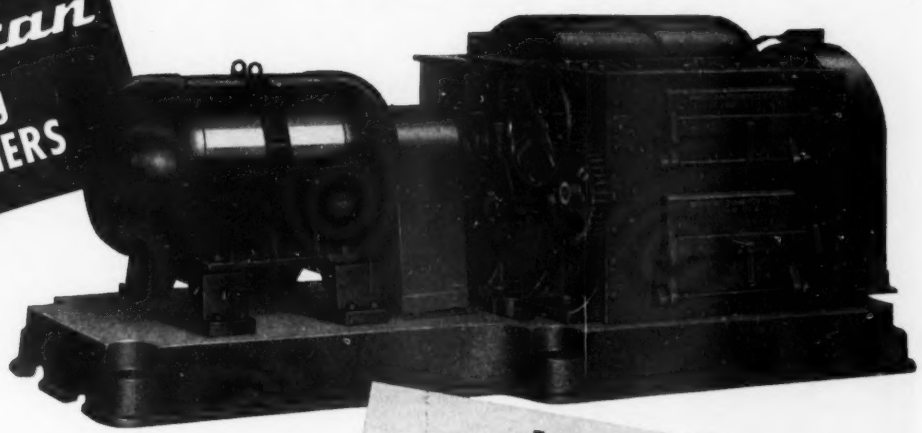

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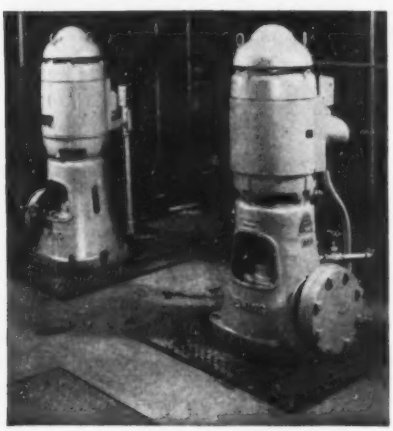

The two Deming Turbine Pumps illustrated are part of the air conditioning system at the United Nations Building in New York City. Salt river water from the East River flows through conduits to the third basement level and is pumped through rotating drum type screens to free it of foreign matter before use in the air conditioning systems. The Deming Pumps wash the rotating screens to prevent them from clogging.

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DEMING PUMPS

More TECHNICAL BRIEFS

Begins on page 156

panel. Panels consisting of 2- or 3-pole breakers which can be applied on a 460-v system are somewhat more expensive than the panel boards containing single-pole breakers which are used when the lights are connected from line to neutral. *AIEE Paper No. 53-73.*

Electric Power Systems 240- and 416-Volt, 3-Phase Power and Lighting Supply for Modern Industrial Plants. *By William Shuler, Dayton Power & Light Co.*

The use of 277-480-v, 3-phase, 4-wire grounded neutral distribution system has been suggested for manufacturing plants. This system permits supplying power and lamps from the same feeders by connecting the 440-v motors and other large loads to the 3-phase conductor and the lamps from phase to neutral conductors. The author disagrees with this suggestion, but while accepting the advantages of a 3-phase, 4-wire grounded neutral system for both power and lighting, the superiority of a 240-416-v system over the 277-480-v system is demonstrated. The 240-416-v system is, he said, preferable for at least four reasons:

1. It permits the use of fluorescent lamps which have already been designed and cataloged and will not require the development of another complete new line of accessories.

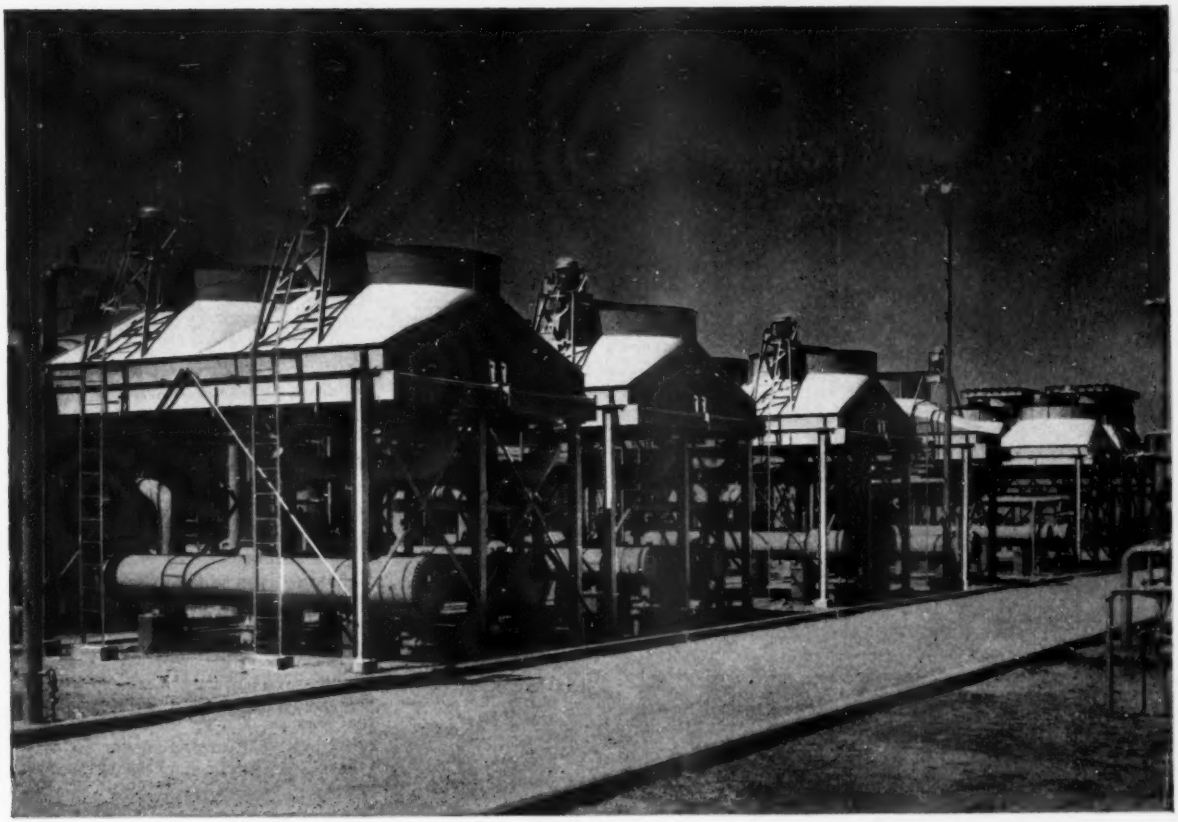
2. The Underwriters' Laboratories have placed a 250-v limit on general purpose switches for lighting circuits. The phase to neutral voltage of the 240-416-v system is below this limit. The 277-480-v system requires remote control for all lighting circuits and hence adds more expense as well as complications to the distribution system.

3. It will permit the use, in 3-phase banks, of single-phase transformer having a low-voltage winding rated at 240-v.

4. The principal reason for favoring a lower voltage system is that manufacturing plants are now equipped with individual motor-driven machine tools operating at an average load that is far below their rating. When these motors operate at 480 v, 460 v, or even their designed voltage of 440, their power factor is low and efficiency is reduced. It appears from test data which has been taken that the improvement in power factor and efficiency when operated at 416 v results in less current in the secondary feeder than when operated at the higher voltages.

On the author's company low-voltage network system they plan to carry from 122 to 124 v from phase to neutral.

Directions for ordering papers on p 158



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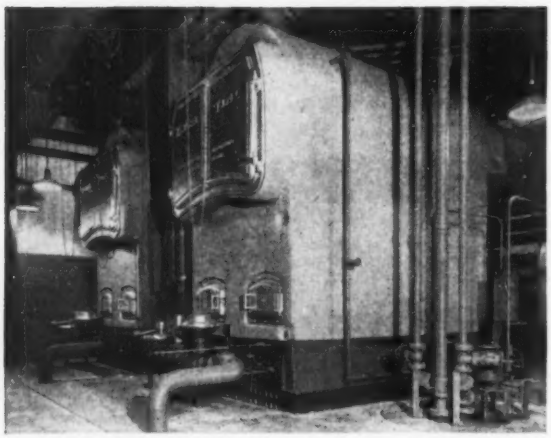

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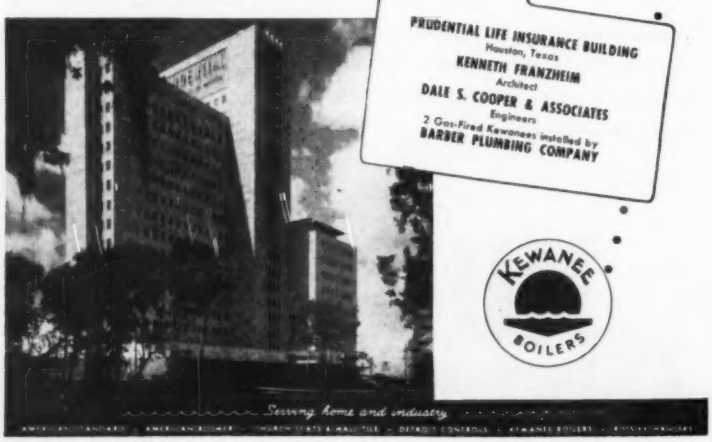

More TECHNICAL BRIEFS

Begins on page 156

Likewise, on a 240-416-v system they plan to maintain from 244 to 248 v from phase to neutral. This gives a 3-phase voltage for motor operation of from 423 to 430 v. It is believed that a voltage of this magnitude is far better from the standpoint of both the utility company and the customer than existing voltages which vary from 470 to 490 v. *AIEE Paper No. 53-72.*

Electrical Innovations in the Alcoa Building. *By Louis N Grier, Aluminum Co of America, Pittsburgh, Pa.*

Five features in the electrical installation of the 30-story Alcoa building in Pittsburgh are new in office building construction. These are: (1) With minor exception, exclusive use of aluminum conductors, (2) exclusive use of rigid aluminum conduit, (3) use of dual low-reaction riser buses, (4) use of an all-aluminum lighting fixture designed as an integral and efficient part of the ceiling panel heating and cooling system, (5) design of a lighting system that can be readily modified to meet changing office arrangements and provide a lighting level of 35 to 50 footcandles. To provide these features requires imagineering in order to overcome the natural human resistance to the use of new materials and new methods, and to make possible today the creation of the building of tomorrow.

Electrical load of the building consists of about 3800 hp motor and 1100 kva lighting load. Power is supplied from four 11,000-kv lines from the Brunot's Island Station of the Duquesne Light Co serving downtown Pittsburgh. Each line connects to a 1,000-kva 3-phase subway-type network transformer, the 208-v secondary of which connects through a 3000-amp network protector and a 4,000-amp circuit breaker serving a portion of the building, and also to a common bus. All floors above the first are powered from a specially designed low-reactance aluminum bus. Each of its three conductors are sector shaped, has 8.346 sq in. cross-section of aluminimum spaced 7/8 in. between conductor. *AIEE conference paper. Can be obtained from the author.*

Directions for ordering papers on p 158

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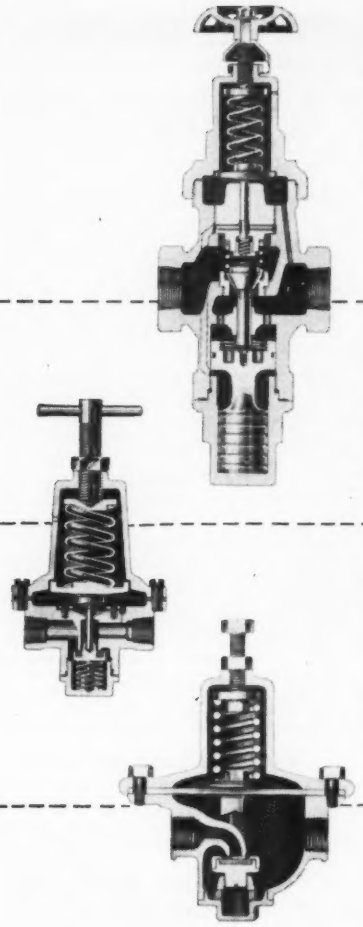

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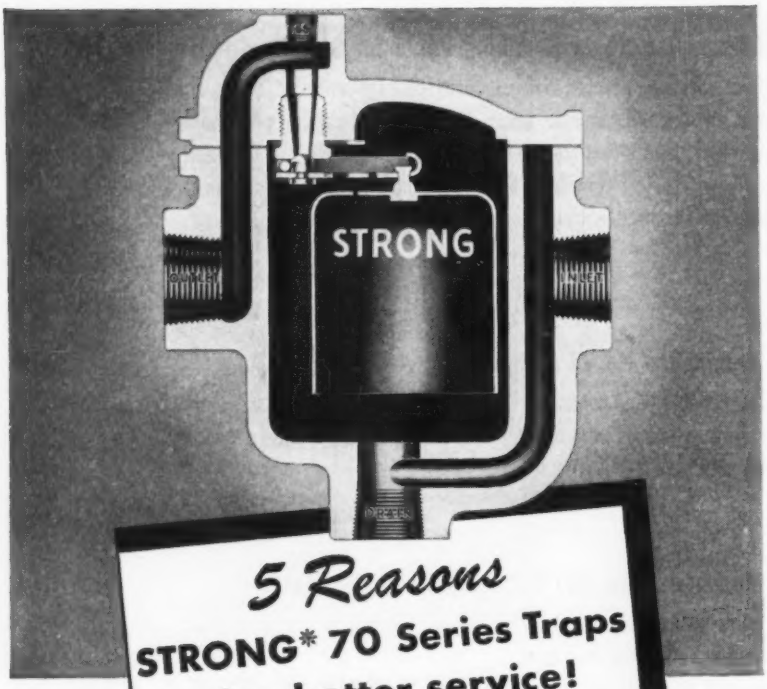

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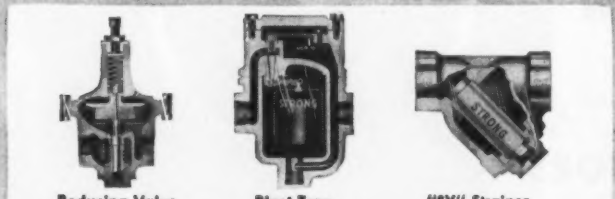

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Begins on page 169

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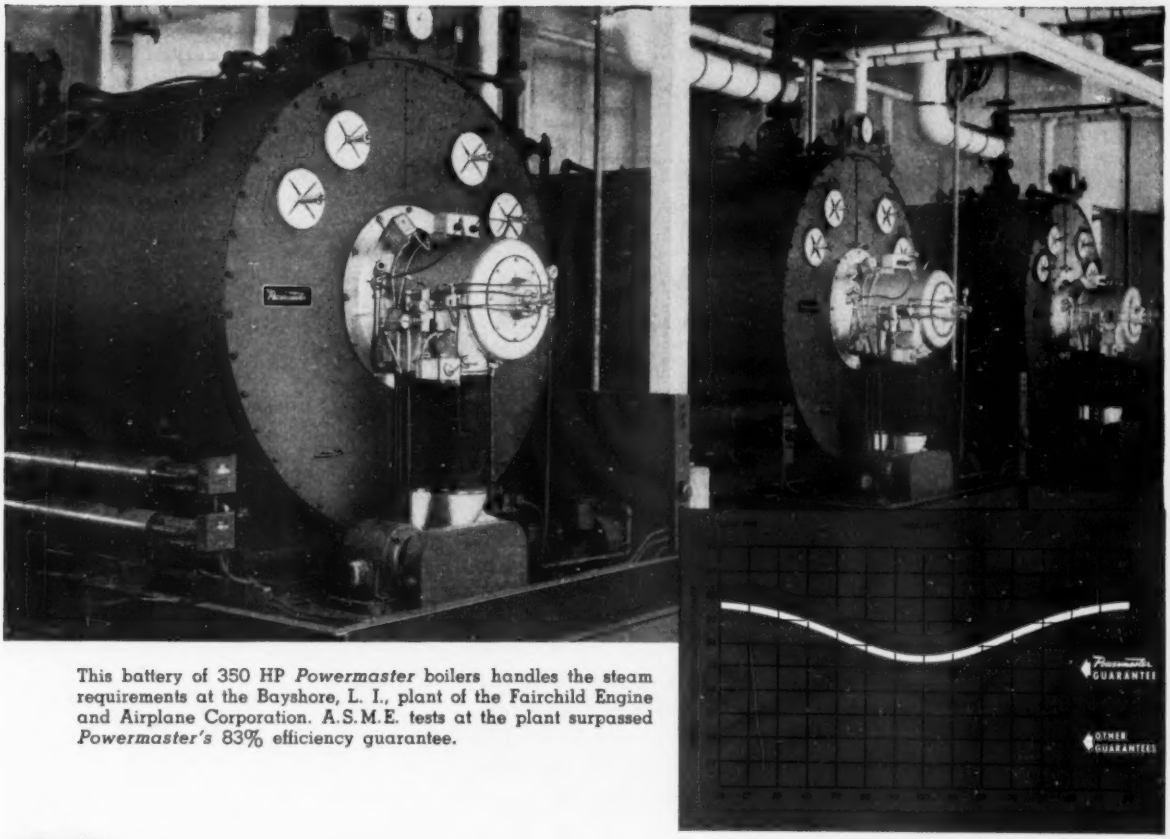

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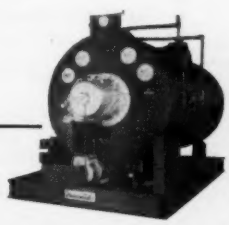

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FOSTER ENGINEERING COMPANY • UNION, N. J.

More FREE BULLETINS

Begins on page 169

METERS AND INSTRUMENTS

31 **Indicating Recorders and Controllers**—design, construction, application, typical circuits. Catalog ND44(1), 40 pages. Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 44, Pa.

32 **Meter**—mercury flow type indicating, recording and totalizing meter for water, gas, air, sewage, sludge, etc. Bulletin 401, 20 pages. Simplex Valve & Meter Co 68th & Upland Sts, Philadelphia 42, Pa.

33 **Air Filter** — dehydrator, mechanical filter and automatic trap give instrument quality air, disposable filter cartridge. 2 pages. Hankison Corp, Biltmore Bldg, Pittsburgh, Pa.

34 **Millivoltmeter Type Instruments**— indicators, indicating electronic controllers and excess temperature safety cut-off controllers. Catalog 1053, 20 pages. Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Sta 64, Wayne & Windrim Aves, Philadelphia 44, Pa.

35 **Indicating and Controlling Pyrometers** — design, application, operation, principles, construction and specs. 12 pages, GEC-713B. General Electric Co, Schenectady 5, N. Y.

36 **Photo Electric Recorder Applications** — textiles, metals, fatigue, corrosion. 12 pages, GEA-5536. General Electric Co, Schenectady 5, N. Y.

PIPING, VALVES, FITTINGS, SPECIALTIES

37 **Liquid Level Gages**—reflex type, liquid shows black with mirror-like appearance in empty space above, also tubular and flat gages. Jerguson Gage & Valve Co, 80 Fellsway, Somerville 45, Mass.

38 **Non-Slipping Handwheel**—to stop valve leakage, lengthen valve life. 2 pages, Circular 501. The Lunkenheimer Co, Box 360U, Cincinnati 14, Ohio.

39 **Bronze Globe Valves**—globe, angle and check bronze valves, for 125 psi steam, 200 psi water. 4 pages, Circular 582. The Lunkenheimer Co, Box 360U, Cincinnati 14, Ohio.

40 **Instrument Tubing** — plastic and metal with plastic covering, corrosion proof. 4 pages, Bulletin L-6506. Samual Moore & Co, Dekoron Tubing Div, Mantua, Ohio.

41 **Pressure Regulators**—diaphragm-operated spring-opening and closing regulating valves, pressure controllers, air locks, valve positioners and selector panels. 12 pages, Bulletin S-22-CA. The Swarthwout Co, 18511 Euclid Ave, Cleveland, Ohio.

42 **Solenoid Valves**—complete catalog with all data and specs. 80 pages, Catalog 24. Automatic Switch Co, Orange, N. J.

43 **Safety Shutoff Valve**—checks fuel-fed fires, temperature actuated. 4 pages. Valco, Inc, 1410 West St, Cincinnati 15, Ohio.

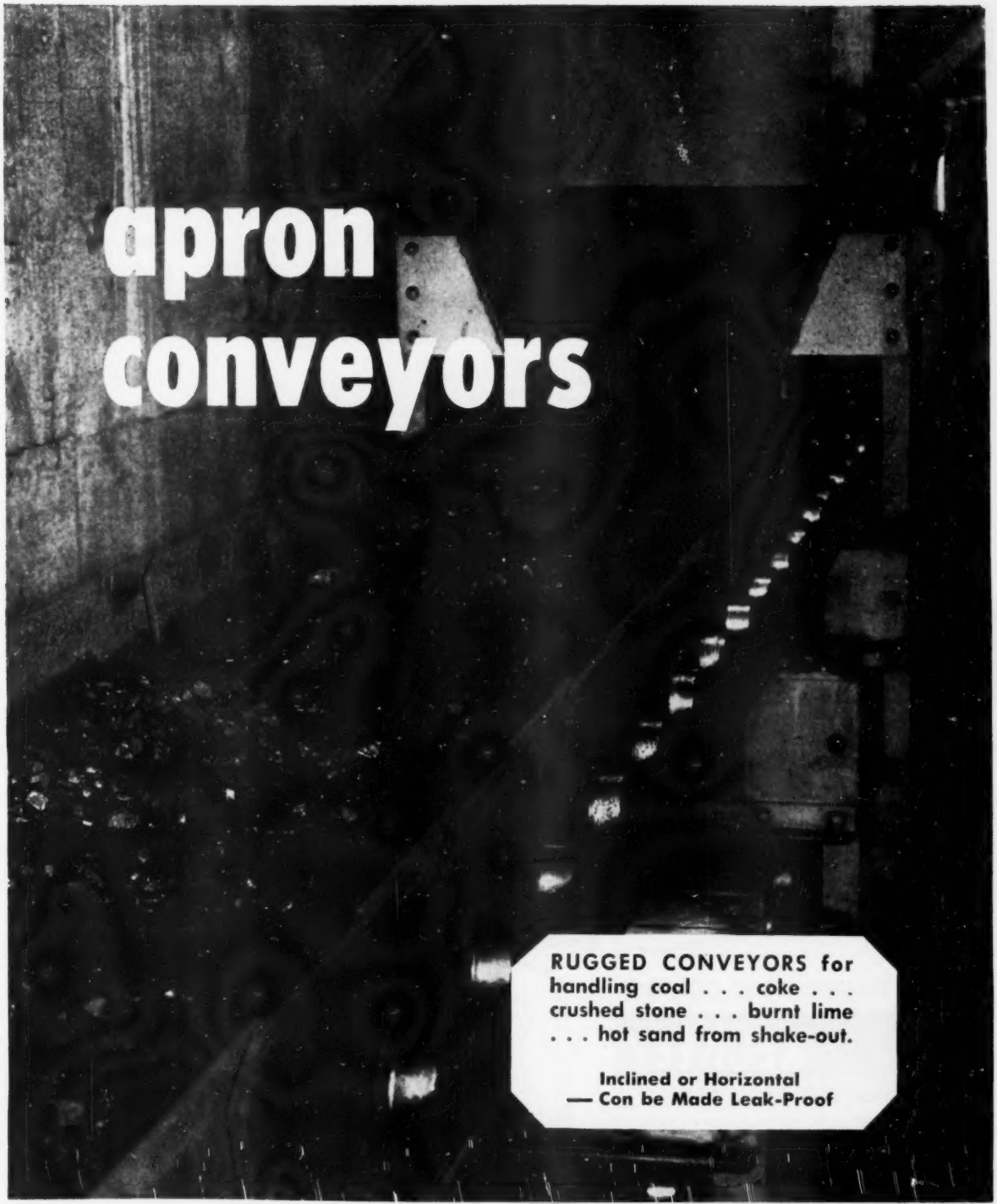
44 **Tube Fittings**—brass cutoff valves, flare tube fittings, compression fittings, copper tube tools, etc. 12 pages, Catalog 253. Universal Brass Corp, 855 Kearny Ave, Arlington, N. J.

45 **Pipe Line Filters**—designed for low pressure up to 40 psi, combines mechanical separation, filtration. 4 pages, Bulletin 210. Dollinger Corp, 11 Centre Park, Rochester 3, N. Y.

46 **Modern Steel Bolting**—for Piping and Pressure Vessels is title of ASME reprint, 14 pages plus tables, issued as Bulletin 524. Taylor Forge & Pipe Works, P O Box 485, Chicago 90, Ill.

PUMPS

47 **Small Centrifugal Pumps**—close-coupled, motor-driven, 1 in. and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Inclined or Horizontal — Con be Made Leak-Proof

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IF IT'S MINED, PROCESSED OR MOVED

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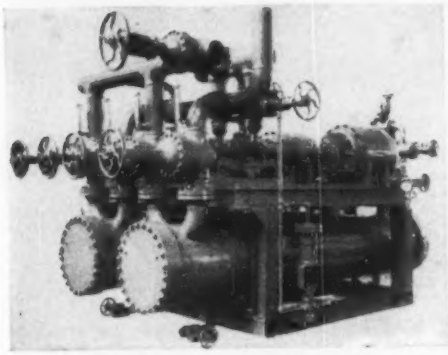
LOCKETT FUEL OIL PUMPING AND HEATING SETS



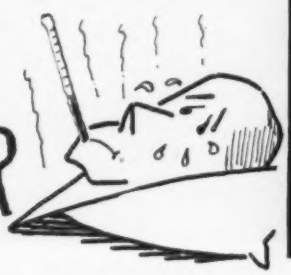
Custom Built

The compact, high-pressure Unit illustrated here was built for a large Utility Station in the South West. It consists of two Motor-driven Pumps and two Shell - and - tube - type Oil Heaters mounted on a single frame. Each pump is designed to handle a capacity of 55,000 pounds per hour of bunker fuel oil, against 300 P.S.I.

For almost a half century, Lockett has been supplying, to fit individual needs, efficient standard and custom-built, Fuel Oil Pumping and Heating Sets, for mechanical and steam atomizing oil burners. Combinations of various types of pumps are available: Either two Turbine-driven Pumps; one Electric-driven and one Turbine-driven Rotary Pump; two Electric-driven Rotary Pumps; two Worthington Duplex Steam Pumps; or one Duplex Steam Pump and one Electric-driven Pump. Each pump-and-heater is suitable for the full rated capacity of the unit; the second pump and heater are spares. Lockett supplies everything, complete. Inquiries are invited. *Descriptive bulletins sent on request.*

A. M. LOCKETT & COMPANY, LTD.
Contracting Mechanical Engineers
NEW ORLEANS - HOUSTON - DALLAS - GALVESTON

HIGH FEVER



due to
FAULTY TEMPERATURE CONTROL

- Wide Temperature Ranges
- Sensitive Control
- Pressures 20 to 250 psi
- Sizes ½ to 6"
- Easily Adjustable
- Low Maintenance

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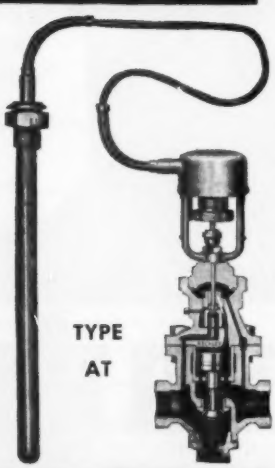
TEMPERATURE REGULATORS

If you're in a feverish sweat because of a tough temperature regulating problem, you can set your mind at ease by standardizing on Keckley. Keckley regulators offer you positive, accurate control of kettles, vats, water heaters, or wherever temperature control is needed. You get extreme sensitivity and wide selection of temperature ranges from −40° to 340°F. No decrease in maximum pressure of 250 psi as size increases. This valve incorporates Keckley's basic Type AA regulator, interchangeable with their pressure, temperature and combination control units for simplified maintenance. Give complete requirements including operating temperature range desired. Check with Keckley today!



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O. C. KECKLEY COMPANY
400 W. MADISON STREET CHICAGO 6, ILLINOIS

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Begins on page 169

1¼ in. discharge, capacity to 70 gpm, head to 110 ft. 2 pages, Bulletin 211. Carver Pump Co, Muscatine, Iowa.

48 **Multi-Stage Pumps**—2, 3, 4 and 5 stage, split-case pumps, capacities to 3000 gpm and heads to 1550 ft, temps to 300 F. 12 pages, Bulletin B-1400. Peerless Pump Div, Food Machinery & Chemical Corp, 301 W Ave 26, Los Angeles 31, Calif.

49 **Centrifugal Pumps**—single-stage, double suction, made in 66 standard sizes, 1½ to 72 in. discharge, capacities to 225,000 gpm, heads to 900 ft. 24 pages, Bulletin 08B6146B. Allis-Chalmers Mfg Co, 952 S 70th St, Milwaukee, Wis.

50 **Controlled Volume Pumps**—positive displacement, either simplex or duplex, 1¼ to 16 gph. 4 pages, Bulletin H-20-M. Milton Roy Co, 1300 E Mermaid Lane, Philadelphia 18, Pa.

51 **Chemical Feeder**—automatic and proportional, hydraulically operated, controlled by standard water meter. 4 pages, Bulletin SAN-6. Proportioneers, Inc, P O Box 1442, Providence 1, R. I.

52 **Diaphragm Feeder Pump**—all purpose, positive displacement, for water to hydrofluoric acid. 4 pages, File 1201-1. Proportioneers, Inc, P O Box 1442, Providence, R. I.

53 **Industrial Waste Treatment Guide**—gives problems, processes, equipment, plus general flow diagram for mixed wastes. 8 pages, Bulletin B-I-F 4. B-I-F Industries, P O Box 1342, Providence 1, R. I.

54 **Main and Emergency Sterilization**—of newly laid water pipe and mains, etc. Sterilization chart. 8 pages. Proportioneers, Inc, P O Box 1442, Providence 1, R. I.

PRIME MOVERS AND ACCESSORIES

55 **Diesel Engines**—What You Should Know About Them, gives history, design, operation and latest developments in non-technical language. 28 pages. P & H Diesel Div, Harnischfeger Corp, Crystal Lake, Ill.

56 **Spark-Fired Gas Engines**—four cycle, 9 and 13 in. bore sizes, 265 to 4260 hp. 4 pages, Bulletin 221. Nordberg Mfg Co, Milwaukee 1, Wis.

57 **Dual Fuel Engines** — two cycle, manual or automatic changeover, 17½, 21½ and 29 in. bores. 16 pages, Bulletin 202. Nordberg Mfg Co, Milwaukee 1, Wis.

58 **Water Side Deterioration**—of Diesel Engine Cylinder Liners, reprint, gives reasons and protective measures. 8 pages. The International Nickel Co, New York 5, N. Y.

59 **Stationary Diesels** — dimensions, weight, technical data of engines sized 8 to 27 bhp at 1500 to 1800 rpm and 36 to 54 bhp at 1000 to 1800 rpm. 4 pages each, Bulletins 5204 and 5205. The National Supply Co, Engine Div, Springfield, Ohio.

60 **Diesel Engines**—162 and 184 bhp at 2400 rpm, vertical and horizontal in both models. 6 pages, Bulletin L-6841. Twin Coach Co, Kent, Ohio.

61 **Automatic Engine Stop Valve**—application, fabrication, installation and design, dimensions and specs. 6 pages, Bulletin S-3. Golden-Anderson Valve Specialty Co, 2070 Keenan Bldg, Pittsburgh 22, Pa.

62 **Flow Control Valve**—to control the speed of piston stroke in a cylinder, one valve controls each cylinder in one direction. 2 pages, Bulletin 4810. Airmatic Valve, Inc, 7317 Associate Ave, Cleveland 9, Ohio.

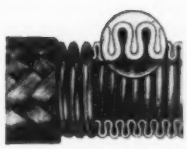
MISCELLANEOUS

63 **Pneumatic Tubes**—for fast paper work communication between offices and shops. 50 pages, title "On Target." Lamson Corp, Syracuse 1, N. Y.

64 **Isotope Chart**—of nuclides, 26 by 50 in., includes nearly 1300 iso-

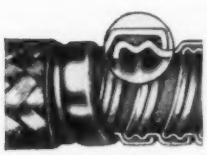
CMH

One dependable source for every flexible metal hose requirement



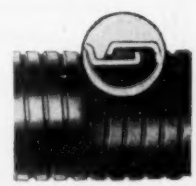
CMH corrugated hose is available with metal braid covering or unbraided in steel, bronze or stainless steel. Used where great flexibility is required at high temperatures and high pressures. Sizes range from 3/16" I.D. to 24" I.D. Depending on size, type and material, it will handle burst pressures to 12,000 psi, temperatures to 1200° F.

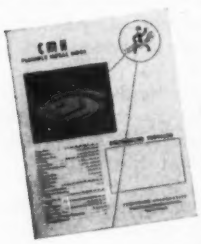
CMH interlocked hose is available in various types, packed and unpacked, in steel, stainless steel, bronze, aluminum, brass and other metals. It is used for steam, exhaust, tar and asphalt, etc. Sizes ½" to 12", I.D. Depending on size, type and material, it may be used for working pressures to 750 psi (constant), temperatures to 600° F.



CMH double groove (ball bearing design) hose is available in bronze, steel or stainless steel with asbestos packing and with or without metal braid covering. Widely used for non-searching liquids and gases at low to moderate pressures and temperatures. Sizes range from ½" to 1¼", I.D.

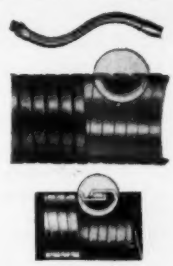
CMH square locked hose is available unpacked or with a choice of several types of packing in steel, bronze, brass, aluminum, stainless steel, etc. It is used as conduit, cable armor, nozzles and many similar applications. Sizes range from 3/16" to 1", I.D. Normally used only at very low pressures.





For full information on all CMH hose products write for Catalog 130 or see the Flexonics catalogs in Sweet's Plant Engineering File, Chemical Engineering Catalog and The Refinery Catalog. For maintenance hose, see the classified pages of your telephone directory for the name of your CMH distributor.

Standard assemblies and special purpose flexible metal hose items are manufactured for such services as steam, tar and asphalt, machine tool coolants, machine tool wiring conduit, dry granular products. We will be pleased to send data on any specific requirement.



CHICAGO METAL HOSE Division

Flexon identifies CMH products that have served industry for over 50 years.

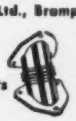
CMH

Flexonics *Corporation* 1301 South Third Avenue, Maywood, Illinois

In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

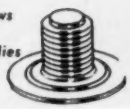
Flexible metal hose

Expansion joints

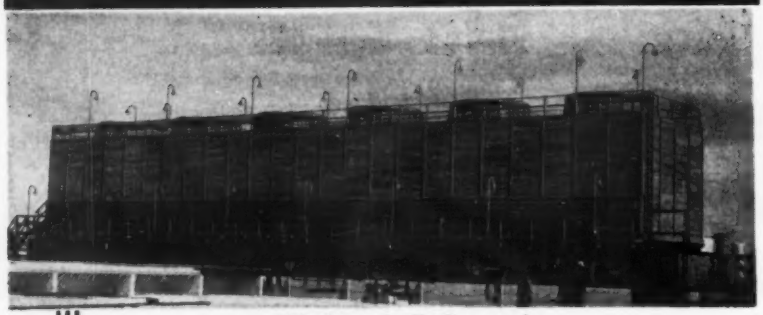


Aircraft components

Metallic bellows and bellows assemblies



UNITED Builds Dependable Towers
for All Water Cooling Purposes



United tower in oil refinery service

Mechanical Draft Towers featuring low pressure, closed system water distribution, redwood interiors and effective counterflow cooling over large deck surfaces.

Atmospheric Deck Type Towers of redwood throughout, with closed low pressure distribution through sprinklers or spray nozzles.

"Package" Type Towers of steel or wood, mechanical or natural draft, in 3 to 15 tons capacity.

Bulletin No. 50 gives full details. Yours upon request.

UNITED COOLING TOWER CO.

4022 Broadway, Kansas City 2, Mo. Plant: Pilot Point, Texas

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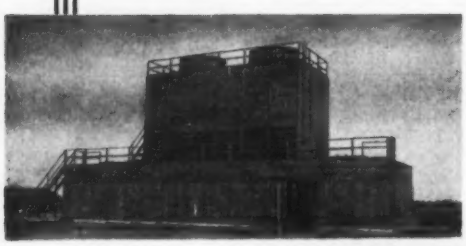
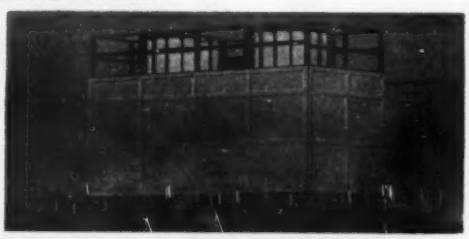


United compressor plant installation

United air conditioning tower, large public bldg.



UNITED

COOLING TOWERS

More FREE BULLETINS

Begins on page 169

topes, 98 elements in checker-board arrangement, plus 8-page explanatory booklet. General Electric Co, Dept 2-119, Schenectady 5, N. Y.

65 Putting Ideas to Work—booklet describing the non-profit organization that reviews and develops ideas for technical development. The Battelle Development Corp, Columbus, Ohio.

Self-Lubricating Bearing Standards

Bearings made from sintered metal powders and impregnated with oil to make them self-lubricating now have two Standards developed by the Metal Powder Association. Designated 14-51T and entitled "Metal Powder Sintered Bearings (Oil Impregnated) Preferred Dimensional Specifications," the first establishes a list of preferred bearing sizes commonly available from all manufacturers and, at the same time, correlates the bearing dimensions with those of stock shafting sizes and standard dimensions of other items of importance to bearing users. Dealing principally with dimensional specifications and tolerances this Standard does not specify other important factors such as composition, basis of purchase, density, porosity, crushing strength requirements and others necessary in the purchase of such bearings. The latter requirements have now been met in a new MPA Standard just released.

The new Standard is designated 16-52T, "Specifications for Metal Powder Sintered Bearings (Oil Impregnated)," and is identical in substance to ASTM Standard B202 prepared originally by ASTM Committee B-9. By referring to both MPA Standards it is now possible for all users of self-lubricating bearings to find complete industry-wide specifications in one place.

Copies of the Standards may be obtained at 25 cents per copy from the Metal Powder Association, 420 Lexington Ave, New York 17, New York.

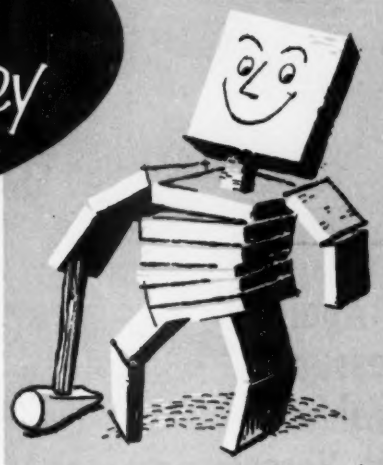
The Sky is the Roof, a color sound film featuring the newly developed Allis-Chalmers weather-protected motor for outdoor service, has been announced by the company. The film introduces the weather-protected motor with a brief background history of its development and shows the storm tests to which it was subjected.

The movie shows how the motor, while running at normal speed and voltage, was deluged with water at rates up to 40 inches per hour driven by winds up to 75 miles per hour. The film runs about 12 minutes. It is available through the district offices of Allis-Chalmers general machinery division, Milwaukee 1, Wisconsin.

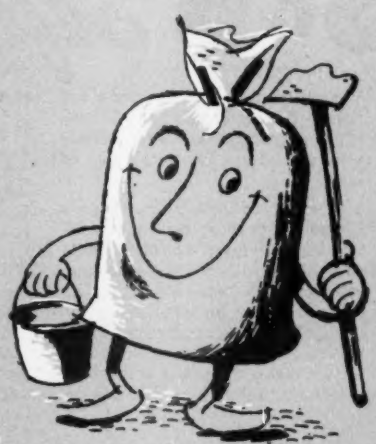
Two handy helpers that save time and money

HARBISON-WALKER Plastic Fire Brick and Castable Refractories

These versatile refractory products can be used for a multitude of important jobs around your furnaces and boilers—from the construction of a complete monolithic lining, to patching a roof, wall or hearth. Harbison-Walker Plastic and Castable Refractories are made in all the various classes, are easy to prepare and apply, and are readily available from nearby stocks.



H-W PLASTIC FIREBRICK
is made in standard and super classes. Slabs two inches thick are packed in cartons ready to apply by ramming.

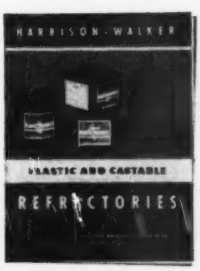


H-W CASTABLE REFRACTORIES
may be used like concrete or applied by gun placement methods. They are made in eight classes, for every kind of service. Shipped dry, ready for mixing with water.

Send for information

BULLETIN EB-11

Complete data on all grades of Harbison-Walker Plastic Fire Brick and Castable Refractories are given in Bulletin EB-11.



HARBISON-WALKER REFRACTORIES COMPANY
AND SUBSIDIARIES

World's Largest Producer of Refractories

General Offices: **PITTSBURGH 22, PENNA.**

Protect Against Overpressure from within Pressure Vessels with

BS&B *Safety Heads*

We make the rupture discs for BS&B Safety Heads out of these rolls of thin ductile metal. These rolls are only a few examples of our supply.

You see, rupture discs—which insure protection against overpressure for hundreds of types of pressure vessels in the petroleum, chemical processing and power industries—must be accurate within 5% of their various rated pressures of 5 to 40,000 pounds. Out of every lot we make, 1 disc out of every 6, selected at random, is tested to destruction to insure this accuracy.

It has taken years of research to know exactly what metals do each job best—for the pressures involved, for the liquids or gases involved depending on their corrosive or bland nature.

All this research has made BS&B Safety Heads and their rupture discs the world's accepted standard for secondary (and often primary) protection against pressures. That's why they're code-accepted—and guaranteed.

Get all the facts: No matter what your pressure applications are, there's a Safety Head for you. Write for complete BS&B Safety Head Catalog . . . or ask your BS&B Man. There's no obligation for a complete analysis of your pressure safety requirements.

SAFETY BS&B HEADS OUR 60TH YEAR

BLACK, SIVALLS & BRYSON, INC.

Safety Head Division, Dept. 2-Q5

7500 East 12th Street Kansas City 26, Missouri

My Biggest Boner

► OUR PLANT has a large exhaust system for removing chips and sawdust from wood-working machinery. Shavings from each machine are sucked into a duct and discharged into fireproof boxes kept in the shipping room. Chips, shavings and sawdust are eventually used for packing our manufactured products.

One day recently a soldered seam in a duct split. Sawdust and shavings leaked out and blew all over the floor. Our maintenance man shut off the main exhaust fan so we could make repairs.

He grabbed a gasoline blowtorch and a bar of solder before climbing a ladder to reach the duct. He worked no more than five minutes before sirens began to sound in the street outside our plant. In another minute the street was full of fire engines.

Shavings in duct had been ignited by heat from the torch. Flames shot through duct to every production area in plant and to the shipping room. Luckily, duct confined the flames and firemen were able to put them out in a few minutes.

But I know it's the last time he or anyone else in our shop will bring an open flame near sawdust, shavings or wood chips. You're asking for trouble every time you do.

FRED LETTINO *Astoria, N. Y.*

● What is your "biggest boner"? We'll pay ten dollars for each one we publish.

Sydney—(*McGraw-Hill World News*)—South Australia hopes to have a 100,000 to 400,000 kw atomic power house operating by 1958, according to a recent statement by the State Director of Mines, S B Dickinson. "South Australia has very low fuel reserves and is possibly the one area in the British Commonwealth where atomic energy would be economical today," said Dickinson. Extraction of uranium from the ore will likely be carried out at Port Pirie.

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DESIGNERS and BUILDERS
BRIDGES AND UNLOADERS • TOWER-TYPE UNLOADERS
WHIRLER CRANES • FLOATING CRANES
DRAVO RAIL CLAMPS • BARGE SHIFTERS
MODERNIZED TROLLEYS FOR EXISTING BRIDGES
This new rope-operated coal unloader was designed, built, and installed by Dravo for a large power generating plant on the Monongahela River.
The unloader is equipped with a seven-and-one-half-ton bucket and has a free-digging capacity of 800 tons per hour for unloading coal from river barges.
Many power companies and industrial plants have called on Dravo Corporation for similar installations. Why not make use of Dravo's more than 60 years of practical experience when planning a material-handling project?
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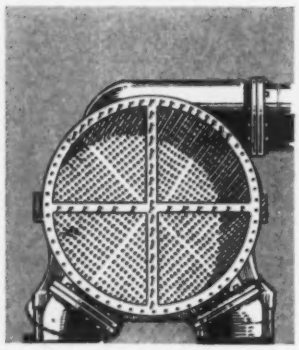
NEVILLE ISLAND, PITTSBURGH 25, PENNSYLVANIA
AIR CONDITIONING • BOILER AND POWER PLANTS • CRANE CAB COOLERS • DOCKS • INDUSTRIAL FOUNDATIONS • OPEN STEEL FLOORING
PUMP HOUSES AND INTAKES • SPACE HEATERS • WATER AND WASTE TREATMENT PLANTS • TOWBOATS AND BARGES

SAVE STEAM



by keeping condensers Oakite-clean!

BTU's fly up the stack when sludge and hard-water scale bog down condensers.

Here's how to stop this waste. Try Oakite's proved method of maintaining condensers. Powerful Oakite alkaline cleaner removes sludge . . . then use Oakite Compound No. 32 to dissolve lime scale—fast. Job is done in place, by circulating or soaking. No time-wasting dismantling of equipment.

Results? Rated heat transfer restored with less downtime, less effort, at less cost.

Get the facts free. Call your local Oakite Technical Service Representative. Or write for free, illustrated digest of 71 Oakite maintenance cleaning procedures. No obligation. Oakite Products, Inc., 23 Rector St., New York 6, N. Y.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS • METHODS • SERVICE

Technical Service Representatives Located in Principal Cities of United States and Canada

APPOINTMENTS

Corporation Executives

Election of Rex Reeder, executive vice-president, Marine National Exchange Bank, Milwaukee, to the board of directors, **Allis-Chalmers Mfg Co,** has been announced. Richard N Mathews has been elected vice-president of **Kewanee-Ross of Canada, Ltd,** and placed in charge of the firm's new general offices at 57 Bloor Street West, Toronto.

Albert B Diss has been appointed vice-president and general manager, **The Watson-Stillman Co,** Division of H K Porter Co, Inc, Roselle, N. J. Dwight Douglass, production manager of the **Hartford Electric Light Co,** has been appointed assistant vice-president of that utility and of the **Connecticut Power Co,** Hartford.

Election of LeRoy A Petersen, president of Otis Elevator Co, as a director of **American Locomotive Co** is announced. George D Ellis, vice-president and controller, **Combustion Engineering-Superheater, Inc,** New York, has been elected a director. **The National Aluminate Corp** of Chicago, recently announced the promotion of Heman R Powers, Dr David G Braithwaite and Gage Averill each to the post of assistant vice-president.

Operations Executives

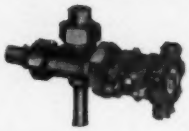
Three executive appointments in the **Westinghouse Electric Corp's** Switchgear Division were announced: Maurice H Hobbs is appointed assistant manager; Charles P West becomes manager of engineering; and Charles E Bickham, manager of order service. J P Coughlin becomes manager of the arc welding department, and Edmund T Morris is appointed assistant manager of the Westinghouse Atomic Power Division, Pittsburgh, Pa.

George A Fort steps from manager of quality control to general manager of the Rubber Division of the **Parker Appliance Co. The National Aluminate Corp** recently announced the promotion of James Rush to division manager of the east Nebraska-Iowa territory. John P Kelley has been named works manager of **Allis-Chalmers** Boston Works. Joseph L Desmond has been appointed to succeed Kelley as superintendent of production.

Donald W Lloyd, general superintendent of Brier Hill Works, **The Youngstown Sheet and Tube Co,** has been appointed general superintendent of the steel plant at Indiana Harbor, East Chicago, Ind. He succeeds George W Abel who died recently. Thomas Bruce Carpenter, superintendent of the open hearth department at the Brier Hill Works, succeeds Lloyd as general superintendent. James W Kirkpatrick, chief metallurgist in the Youngstown district, succeeds Carpenter as superintendent, and Ernest B Plott, steel plant metallurgist, becomes chief metallurgist in the Youngstown district, replacing Kirkpatrick. Charles T McClure, formerly with Youngstown Steel Products Company of California has joined The Youngstown Sheet and Tube Company as superintendent of field engineers, tube

Sound Design
Quality Materials
Precision Workmanship
the superiority of JERGUSON VALVES speaks for itself

OS&Y Valves for severe conditions



Rugged Jerguson OS&Y Valves are the ideal answer to meet high temperature or corrosive conditions where inside threads can't be tolerated. Efficient outside thread design eliminates possible freezing and allows the valve stem to work freely at all times.

GA Valves for instrument piping and general use

Tremendous time and cost savings are possible with Jerguson GA Valves. Threaded connections can be reduced from 10 to 3 . . . unions, nipples, reducers, elbows, tees, valve, and bleed valve are combined in one space saving unit.

Jacketed Heated-Cooled Valves

Designed especially for use with heated or cooled gages, Jerguson No. 93 Valves have a surrounding jacket for circulating the heating or cooling medium. They give safe, dependable, leak-tight service.

Globe Valves

Jerguson Globe Valves, furnished in ¼, ½, and ¾ inch sizes with renewable, regrindable seats. Can be furnished with Stellited stem and/or OS&Y.

All valves shown rated at 3000 lbs. @ 500°F. Send for detailed Data Units . . . or outline your requirements and let Jerguson engineers go to work for you.

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Gages and Valves for the Observation of Liquids and Levels
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Pétrole Service, Paris, France

NO MATTER WHAT THE DEMAND

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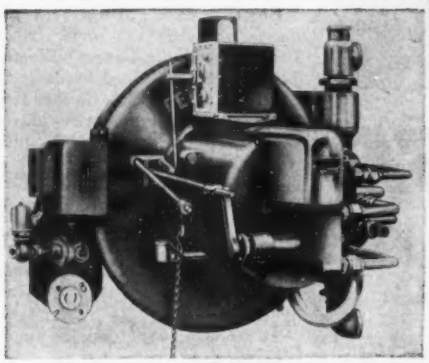
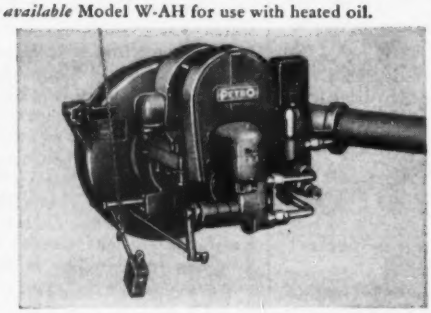
INDUSTRIAL OIL BURNER

to handle it!



Shown above Model WA for use with cold oil.
Also available Model W-AH for use with heated oil.



Model G-W Combination oil-gas.

Cut Fuel Costs with Heavy Fuel Oil

Petro rotary oil burners are built for firing all types of boilers up to 600 boiler horsepower, and also for many other industrial applications. They are designed to burn the low-cost, heavy fuel oils with complete reliability, Petro oil burners slash fuel costs two ways—they burn the *lower priced oils*, and they do it with *outstanding efficiency*. Fluctuating steam demands are answered automatically with Petro modulating flame control. Thousands of owners will tell you that Petro Industrial Oil Burners are fuel savers, labor savers and trouble savers, and their dependability is traditional.

Your heating contractor can tell you about Petro burners. Turn to "Oil Burners" in telephone book yellow pages. See catalog in Sweet's Architectural File, or mail coupon below.

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An oil burner for every need

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PETRO, 3205 W. 106th St., Cleveland, Ohio.

Please send me the Petro catalog of commercial-industrial oil and gas-oil firing equipment.

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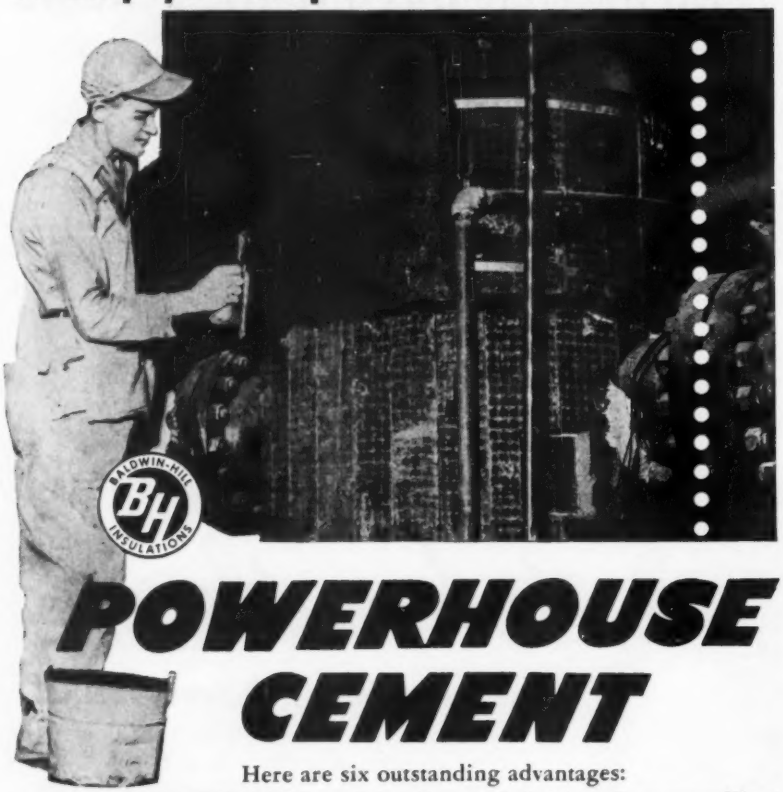
BALDWIN-HILL uses **Power** to help you keep heat losses down with



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Here are six outstanding advantages:

- ONE COAT COVERAGE . . . It insulates as it finishes. Easy trowelling and quick hydraulic setting save time and labor in application.
- GREATER ECONOMY . . . 100 lb. covers 120 sq. ft. 1/4" thick or 30 sq. ft. 1" thick. Low material cost and single coat application provide low over-all installation cost.
- NO WIRE MESH . . . In many instances can be trowelled directly on blocks, blankets, or other surfaces, thus saving costly application of reinforcement.
- DRIES WITHOUT CRACKING . . . Negligible lineal and volumetric shrinkage provides freedom from drying-shrinkage cracks.
- NO WEATHER WORRIES . . . Applied outside, it withstands drenching rain within two hours of application.
- PAINTABILITY . . . The smooth, firm, crack-free surface is perfect for finishing with oil-base or water-base paints.

For further information, get in touch with B-H Engineered Insulation Service.

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Please send complete information on

- ☐ POWERHOUSE CEMENT . . . High adhesion, rockwool, insulating-finishing cement
- ☐ BLANKETS . . . Metal-reinforced, flexible, felted, rockwool insulation
- ☐ NO. 1 INSULATING CEMENT . . . All-purpose, rust-inhibiting, plastic cement
- ☐ MONO-BLOCK . . . Rigid, felted rockwool block—for high and low temperature use

More APPOINTMENTS

Begins on page 254

division.

Eleven staff appointments have been announced in the three newly established departments of the **General Electric Co.** In the Medium Induction Motor Department, the following were named section managers: George I Clover, manager of manufacturing; Glenn A Cook, manager of finance; Charles J Koch, manager of engineering; Joe T Farrell, manager of marketing; Karl F Lathrop, manager of employee relations; and Dwight E Moorhead, manager of the San Jose, Calif., plant. In the new Marketing Department, a product planning practices section is established with Edward A Green as manager. Four men were named section manager in the Synchronous and Specialty Motor and Generator Department located at GE's Lynn, Mass., River Works. They include Bascom H Caldwell, manager of engineering; Lyman E Sproul, manager of finance; James M Sullivan, manager of manufacturing; and David A Yates, manager of marketing.

Horace S Hubbard has been appointed manager of the Transformer Laboratories Department in the **General Electric Co's** Transformer and Allied Products Division, Pittsfield, Mass. **The Cooper-Bessemer Corp** has engaged the services of consultant Robert P Ramsey, recognized authority on industrial market research and product design. **American Blower Corp** announces that J W Ruff has been appointed director of purchases, succeeding R S Reade, who has been made director of purchases for **American Radiator and Standard Sanitary Corp,** the parent organization.

Engineers

Dr Charles M Slack, prominent research physicist, has been named director of research and engineering of the **Westinghouse** Lamp Division at Bloomfield, N. J. Appointment of four new assistant engineers to **Allis-Chalmers'** plant engineering department has been announced. They are William F Bartholomew, Jr, Frederick W Eaton, Jr, Harlowe R Lange and Thomas F Tiefenthaler.

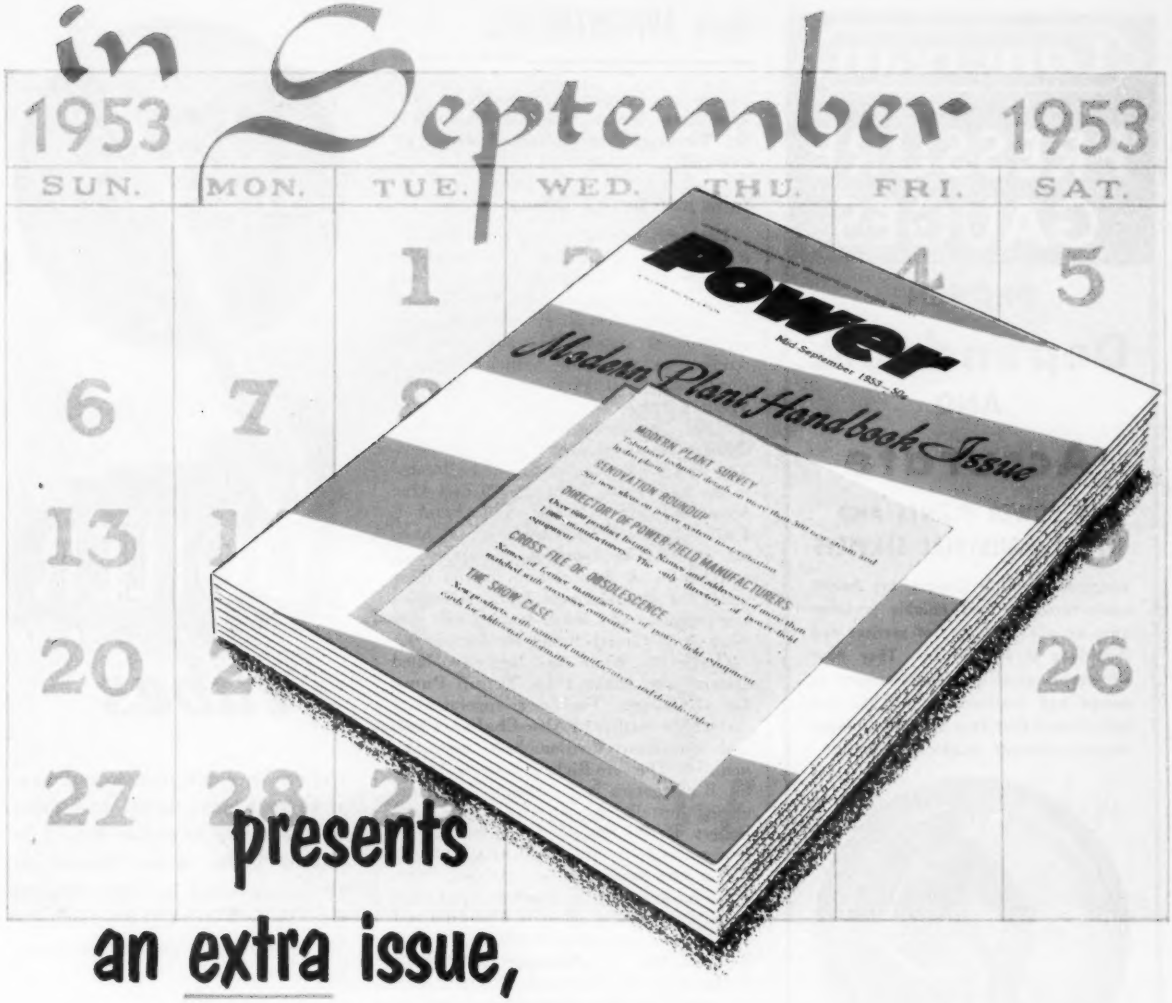
Louis Jay Patrick has been appointed Government Liaison Engineer for **The Kuljian Corp,** and Royston Crewdson is their new representative in the Far East, with headquarters in Tokyo.

Sales Managers, Salesmen

Riley Stoker Corp announces the appointment of Robert A Banck as district manager of the New Orleans territory. Howard B Evans, who has been director of dealer development and sales training for **Iron Fireman Corp** in the North Atlantic states, has been transferred to Los Angeles.

A newly-established division of **Detroit Edison's** sales department—to be known as the Area Development Division—will be directed by Vincent S Madison, former power sales engineer. Bryan Rudder, formerly a sales engineering supervisor with the **A P Green Fire Brick Co,** has been appointed a direct salesman for the Philadelphia office of that company. The ap-

in September 1953



presents an extra issue, geared to a new, important industry trend, featuring reference data of long-established usefulness...

IN IT YOU WILL FIND: POWER's **Modern Plant Survey,** an annual compilation of technical data covering more than 500 new steam and hydro plants . . . **The Renovation Roundup** presents 200 (or more) carefully screened ideas for efficiency and cost-cutting in plant modernization programs . . . **The Directory of Manufacturers** lists names and addresses of over 1,000 manufacturers of power-field equipment, over 600 product categories . . . **Cross File of Obsolescence** tells the names of former manufacturers coupled with the names and addresses of successor companies . . . **The Show Case** is a carefully assembled portfolio of new products, with new product literature described in the same pages and double order cards for readers' convenience.

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Dependable

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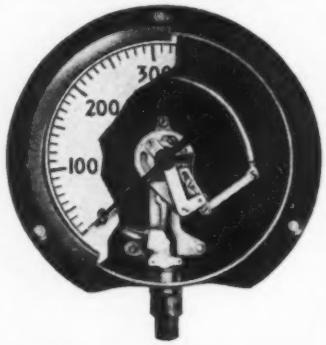
Lonergan Pressure Gauges are known everywhere for their reliable performance on a wide variety of services and thousands of installations. They have undergone *continued* improvements in design and construction over the last half century that have kept them always abreast industry's technical advances.



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This most extensive line includes some 18 types of gauges, more than 100 models and 16 case styles. Sizes range from 2½" to 12" diameter. Your local Lonergan representative can discuss your gauge problems competently. Consult him.

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Full facts and figures are given in our gauge Catalog 800 G. Send for a copy on your business letterhead.

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J. E. LONERGAN COMPANY

Race and Second Sts., Phila. 6, Pa.

Over 80 years experience

More APPOINTMENTS

Begins on page 254

pointment of James O Clevenger as sales manager of general industrial products of the **Westinghouse Electric Corp** is announced.

Sales and Service Offices

The formation of a new Southwest district of the Republic Rubber Division, **Lee Rubber and Tire Corp** has been announced. **Johnson Service Co,** Milwaukee, manufacturers of automatic temperature control systems, has announced the opening of two new branch offices at Charleston, West Virginia, and Roanoke, Virginia.

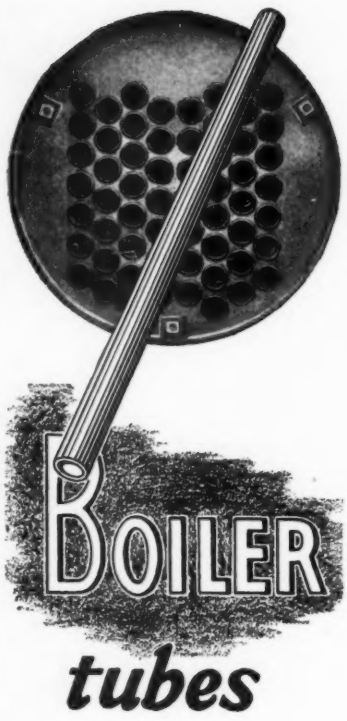
The Cleaver-Brooks Co, announces changes in its eastern office organization. The New York sales office will be located in the Daily News Building, 220 East 42nd Street and will be managed by Frank L Phillips, formerly assistant chief mechanical engineer of Voorhees, Walker, Foley and Smith. A new eastern district office under the supervision of James G Brooks, vice-president of Cleaver-Brooks, will continue at 50 Church Street for the present.

Charles L White has been appointed eastern sales engineer for **Tuthill Pump Co** of Chicago. Four new appointees to the service section of **Allis-Chalmers** general machinery division have been announced. They are Richard R Goetz, Franklin B Gregersen and Howard F Ricker, named installation superintendents, and Robert R Whitehead, appointed service representative for the company's Southeast region with headquarters in Atlanta.

The opening by the **Parker Appliance Co** of district sales offices in Cleveland and Los Angeles is announced. Edward W Hollis, who has been manager of Parker's Rubber Division, Cleveland, Ohio, will head the new sales office to be opened there at 1770 London Road, while Donald T Boody, Pacific Coast sales engineer for Parker's industrial products, will head the new Los Angeles office at 5827 West Century Boulevard, in the plant of Parker Aircraft Co. **Westinghouse Electric Corp** announces the establishing of an Atlanta branch office with Thomas Filler, Jr as manager. He has been manager of the Chattanooga, Tenn., branch office. To implement the branch office staff, Fuller announced the appointment of M A Land as sales supervisor and S M Morton as office manager. George W Miller was appointed distribution apparatus manager.

Along with the Westinghouse reorganization plan, branch service and engineering managers were named. T J Woth was named Atlanta branch engineering manager, and G W Alexander as branch service manager. J J Hill was appointed manager of the Chattanooga, Tenn., office to replace Fuller. E P Athens has been named manager of the Jacksonville, Fla., office. A new office was established at Greenville, S. C., with J H Reeves as manager.

The **A O Smith Corp** announces the opening at Oakland, Calif., of a new service branch of its Product Service Division. George A Carlson is manager of the new branch.



Uniform strength, accurate dimensions and high ductility are three of the many qualities found in Murray boiler tubes. Welded or seamless tubes in sizes ranging from ⅝- to 8-inch OD are available for immediate shipment from warehouse stocks.

If you have a tubing problem, the experience of our specialists and the research facilities of our suppliers are at your service.

Other Murray products include carbon and stainless steel tubing and pipe for pressure and mechanical purposes; welding and screw type pipe and tube fittings. Tube bending, upsetting, swaging.

7251

A B MURRAY CO INC

ESTABLISHED 1845

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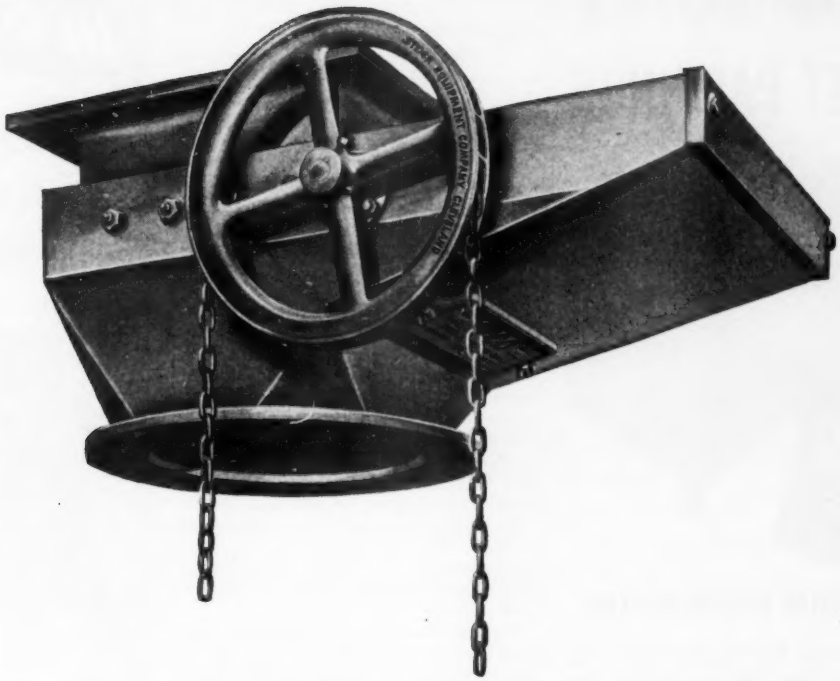
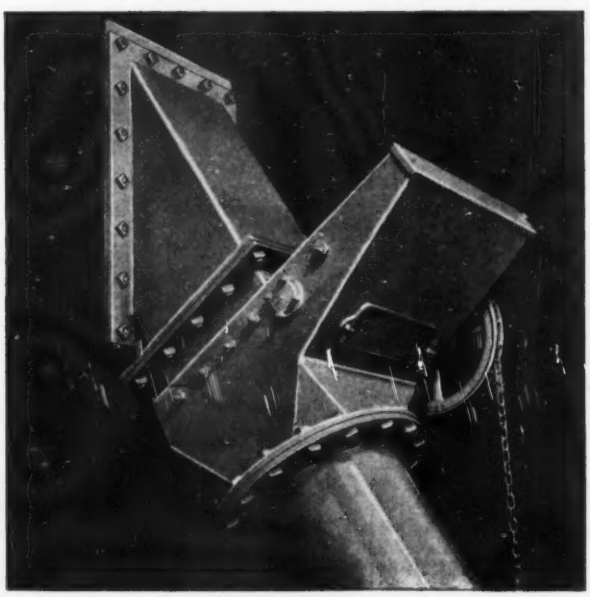


The Operator With the S-E-Co. Coal Valve

S-E-Co. Coal Valve shown below is Style 2BS, designed for inclined installation. This style features 2" offset between inlet and outlet centerlines and a disc brake to prevent gate from self-closing.



can rely on dependable, easy gate operation because the double racks and pinions prevent gate cocking and binding; the U-shaped gate keeps coal and moisture from operating parts and prevents sticking and wear; roller bearing equipped rollers with pressure greasing and dust-seals support the gate and insure free motion; and the operating shaft is mounted on anti-friction bearings.

Purchase your valve requirements from Stock Equipment Company, where valves are a specialty and receive the attention to design and construction they require. Stock Equipment Company has a full line of valves in sizes ranging from 6" to 42" designed to control coal, soot or siftings, or bulk materials. For bulletin or help on your valve problem, write to

STOCK EQUIPMENT COMPANY
745P HANNA BUILDING
CLEVELAND, OHIO

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SHEET PACKINGS

ASK YOUR DISTRIBUTOR

You know the high cost of packing *failure* . . . but do you know the easiest, simplest and most economical way to *prevent* failures? The answer is to put your problem squarely in the hands of an expert . . . your BELMONT distributor. Working in close cooperation with Belmont's service engineers and technicians he is in an ideal position to help you select and apply the proper sheet packings for your services . . . speedily, economically and all from a single reliable source.

Belmont sheet packings and gasket cutters are sold nationally through this experienced distributor organization. Use them and enjoy a new freedom from packing worry. Write on your company letterhead for catalog.

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PACKING AND RUBBER CO.
Butler and Sepviva Streets
Philadelphia 37, Pennsylvania

Rings • Spirals • Coils • Reels
Spools • Sheets • Gaskets
There's a Belmont Packing for every service

More APPOINTMENTS

Begins on page 254

Distributors, Representatives

The **Cleaver-Brooks Co** announces the appointment of J H Ballenger, Cincinnati, Ohio, as a manufacturer's representative for the sale of boiler equipment. The firm is located at 1284 Bursal Ave, Cincinnati 30, Ohio. **The Rust-Oleum Corp** announces the addition of two new industrial distributors: Clark-Fontana Paint Co, 1455 "P" Street, S.W., Washington, D.C.; and Empire Supply Co, Jamestown and Bismark, North Dakota and Fergus Falls, Minnesota.

Burgess-Manning Co announces eight sales representatives for the company's new radiant ceiling. They are: Homans-Kohler, Inc, 126 Massachusetts Ave, Boston, Mass.; Home Conditioning Co, Tenth & Moffett, Joplin, Mo.; Kansas City Natural Slate Co, 2719 McGee Traffic Way, Kansas City, Mo.; Southwestern Insulation & Material Co, 1301 St. Louis St, Springfield, Mo.; Watts Plumbing & Heating Co, 528 East 5th St, Tulsa, Okla.; Interior Materials Inc, 330 N Waco, Wichita, Kan.; Insulation Sales Co, 20 Lakeside Ave, Minneapolis, Minn.; Porter Trustin Co, 910 S Saddle Creek Rd, Omaha, Neb.

Canton Stoker Corp. announces these new representatives: In Chicago, Russell Graeb, formerly in Canton Stoker's Cleveland office, has formed Combustion Equipment Co with offices at 4809 North Claremont Ave, Chicago 25, Illinois. In Toledo, Ohio, James F Guest & Co, 2157 Mansfield Road, and in West Virginia, Loyd A Wildman of Pyro-Neers, Inc, P O Box 563, Charleston 22, will represent the stoker firm.

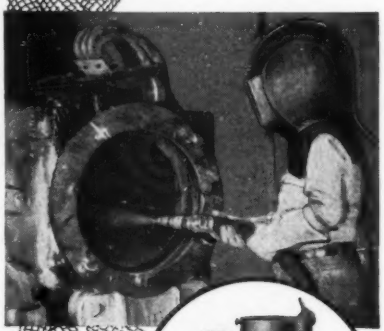
The **John Hewson Co** announces the appointment of two representatives for sales, field application and servicing of its lines: Smallwood-Kemp Engineering Co, 5214 Westchester, Houston 5, Texas; and Powerlite Devices, Ltd, Toronto, Montreal & Vancouver, Canada. They also announce the appointment of A G Moore as its representative for the New Jersey marketing area.

The Burlington Instrument Co, Burlington, Iowa, announces three new representatives: the Harry A Lasure Co, 9041 West Pico Blvd, Los Angeles 35, Calif.; the Robert E Brown Co, 311 Ross St, Pittsburgh 19, Pa.; and the Young & Myers Co, 4550 Main St, Kansas City 2, Mo.

Carl H Drenske will represent the **Republic Mfg Co** of Cleveland, covering the states of California, Washington, and Oregon. His headquarters are located at 15139 Valario Street, Van Nuys, California. The **H K Ferguson Co** reveals the appointment of H Allen Thompson as sales representative. Thompson will be with the San Francisco office. **Orr & Sembower, Inc,** has announced the appointment of Young-Streeter Co, 6202 College Avenue, Indianapolis, as its representative.

Foram Chilena of Augustinas 608, Santiago, Chile, and Lamadrid-Gonzales, Ingenieros Importadores, S.A., of O'Reilly 251, Havana, Cuba, have been appointed exclusive sales and engineering representatives in their countries for **De Laval**

...but it's the best way to CLEAN motors, generators, turbines!



- **CUTS DOWN-TIME**
- **CLEANS WITHOUT SOLVENTS**
- **ELIMINATES DRYING**
- **ELIMINATES TOXIC AND EXPLOSIVE DANGERS**

THE new Pangborn AC-4 Blast Machine cleans motors, generators and turbines faster . . . cleaner . . . and lets you use them sooner because there's no waiting for parts to dry. In fact, dangerous solvents that can lead to explosions, caustic action, and toxic poisoning are completely eliminated!

The AC-4 uses soft, 20-mesh corncob grits to rapidly remove dirt, grease, old paint, etc., in one-third the time, and at 90% less cost than old-fashioned methods. GET FULL DETAILS . . . write, telling us what you clean, to: PANGBORN CORP., 90 Pangborn Boulevard, Hagerstown, Md.

Look to Pangborn for the latest developments in Blast Cleaning and Dust Control equipment

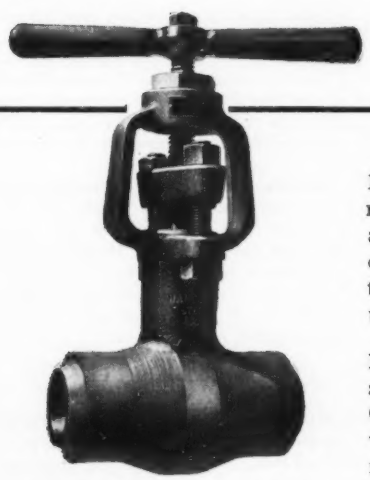
Pangborn
BLAST CLEANS CHEAPER
with the right equipment for every job

GET ALL 24 ADVANTAGES

Choose Hancock

1500# and 2500# STEEL WELDVALVES

1. NO BONNET JOINT TO LEAK.
2. NO GASKET TO LEAK.
3. NO SEAT INSERT TO LEAK—stellite seat is integral.
4. Corrosion-resistant disc minimizes the possibility of cavitation.
5. Disc pad reduces wear on stem and disc connections.
6. Corrosion and galling-resistant disc nut.
7. Simple locking of disc and disc nut.
8. Self-compensating yoke protects seat and disc against wire drawing, leaks and damage.
9. Centerless ground stem—300 Brinell for high resistance to galling, stem pitting, erosion and wear.
10. Non-galling and corrosion-resisting stem guide—essential in a high-temperature valve.
11. Packing inhibited against stem pitting.
12. Non-slotted packing seat.
13. Uniform packing gland load.
14. Alloy steel packing studs—stronger, better.
15. More than adequate stuffing box depth.
16. Corrosion-resisting back seat.
17. No left-hand threads.
18. Simple thread bushing locking.
19. Proved 1500# and 2500# ratings at 1050°F.
20. Design proved in high-temperature valve research and applications since 1935.
21. Meet A.S.M.E. blow-off requirements without special installation.
22. No excess weight to create piping strains.
23. Compactness that saves space.
24. Valve stays in the line for servicing.



High-pressure, high-temperature steam plants must have the safest, most dependable shut-off valves obtainable. That is why Hancock 1500# and 2500# Weldvalves are preferred by the majority of design and operating engineers in such plants. They know from long experience that these rugged valves end the costly hazards of valve leakage—stand up in the severest service.

Hancock 1500# and 2500# Steel Weldvalves are made in ¼" through 2" sizes inclusive. Service rating is up to 2500# W.S.P.—1050°F., and 6000# O. W. G.—100°F. Whatever your needs, remember only Hancock Weldvalves have *all* the design, quality and construction features essential to reliable leak-proof performance. So—protect your personnel, plant and service to customers—install safe Hancock Weldvalves.

When Hancocks go in, valve costs go down

1877 HANCOCK U.S.A.

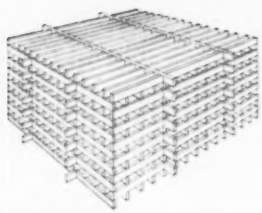
HANCOCK VALVES

A product of **MANNING, MAXWELL & MOORE, INC.** Watertown 72, Massachusetts

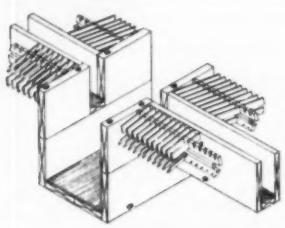
MAKERS OF 'HANCOCK' VALVES, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN' INDUSTRIAL INSTRUMENTS. BUILDERS OF "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES.

4 outstanding features in cooling towers

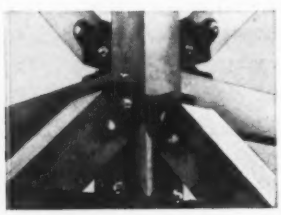
that insure high performance, less maintenance, and long life.



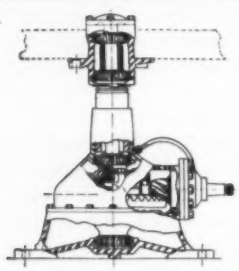
WCEC Improved Nail-less Grid Type Fill provides maximum wetted surface and maximum retardation of water to completely utilize the heat removing capacity of the air, resulting in highest cooling efficiency.



WCEC Patented Drift Eliminators efficiently remove the entrained moisture carried by the air as it leaves the tower, resulting in less water being lost.



WCEC Patented Cast Iron Timber Connectors develop the greatest structural strength of the timber joints, an accomplishment almost impossible to achieve by bolting alone.



WCEC Reduction Gears are the best type for cooling towers because their semi-floating axle prevents any weight or thrust of the fan being transmitted to the gears.

SEE OUR CATALOG IN SWEET'S FILE

Manufacturers of various types and sizes of mechanical draft and atmospheric cooling towers.

Water Cooling EQUIPMENT COMPANY

TOWERS OF STRENGTH WCEC

MAIN OFFICE • 8601 New Hampshire Ave. • St. Louis 23, Mo.

Fabricating Plants: St. Louis, Mo. • Arcata, Calif. • Houston, Texas

REPRESENTATIVES IN TWENTY-EIGHT PRINCIPAL CITIES

More APPOINTMENTS

Begins on page 254

Steam Turbine Co. The Keps Electric Co, 638 Grant Street, Pittsburgh, has been appointed a **Westinghouse** agent-distributor.

New Names, Addresses, Purchases, Etc

Raybestos-Manhattan, Inc, has moved from 445 Lake Shore Drive into its newly constructed Chicago office and warehouse building at 6010 Northwest Highway. The announcement of the opening of a Consulting Engineering office has been made by **Chester F Buckley** of Taunton, Massachusetts. He plans to specialize in engineering work in the utility and industrial field. A new firm, the **H A Pietsch Co,** 894 Heckler Drive, Pittsburgh, has just been organized. The company will handle engineering and sales of equipment for commercial and industrial heating, air conditioning, processing and combustion in the area of Western Pennsylvania, Eastern Ohio and West Virginia.

By vote of the stockholders the name Midwest Piping and Supply Co, Inc, has been changed to **Midwest Piping Co, Inc.** Henry E Sanson and Sons, Inc, announces the formation of a new company, **Henry E. Sanson and Sons Mfg Corp,** to manufacture industrial oils and chemicals.

Societies, Schools, Institutes, Etc

Bituminous Coal Research, Inc, the national research agency of the bituminous coal industry, today announced the appointment of Paul O Kock to the Columbus staff of that organization. He has been assigned to research and development on projects relating to industrial heat and power. Carl L Ipsen retired from the General Electric Co in March to become executive vice-president of the **Industrial Furnace Manufacturer's Association** in Washington, D.C.

Oil-Heat Institute of America, Inc, has moved to new offices at 500 Fifth Avenue, New York 36, New York. **The Heating and Cooling Coil Manufacturers' Association** elected the following officers: L L Simmons, president; Howard F Brinen, vice-president; and Wm P Raffone, secretary-treasurer.

Chief Joseph Dam on the upper Columbia River not only will be producing power earlier than had been anticipated but will cost less, the Corps of Engineers has revealed. The first three 64,000-kw units now are scheduled to go into operation Sept. 1, 1955, three months earlier than the original schedule. Sixteen generators are to be installed by the end of 1958.

Ultimate installation of 27 units, with a total rating of 1,728,000 kw, would make the plant second in size to Grand Coulee among the world's power plants. Estimated cost of the project has been reduced $12.5 million to $193,250,000. Last year saw the placing of 430,000 cubic yards of concrete in the main dam and 109,000 cubic yards in the powerhouse structure.

Two REDLER conveyors take coal from a large steel storage tank to feed boilers as needed. One REDLER unit, 51 feet long, feeds either of two stoker hoppers, through four discharge openings. The second REDLER, 79 feet long, carries coal from storage on an incline to three gated openings, two of them to stoker hopper and the third to a ring type Knittel crusher. The REDLERS pick up their loads without use of special feeders. At all discharge points S-A Tellevel controls prevent jamming of the conveyors.

S-A CONVEYING Systems for

SELECTIVE FEEDING of coal to boilers **WITHOUT DUST**

At this textile mill, sealed S-A REDLER Conveyors take coal from storage—distribute it selectively to boilers—and never leave a trace of coal dust on the boiler house floor . . . "Digging in" to specialized bulk handling needs and coming up with the *one right answer* is the every-day job of S-A engineers. With a wealth of experience and a complete line of handling units, these specialists can help *you* to move any bulk material more efficiently and at lower cost.

Write to have an S-A engineer call. No obligation, of course.

Belt Conveyors
REDLER Conveyor-Elevators
ZIPPER Conveyor-Elevators
Weigh Larries
Crushers, Roll and Ring Type
Bucket Elevators
Pivoted Bucket Carriers
Screw Conveyors
Skip Hoists
Belt, Pan & Plate Feeders
Track Hoppers & Bin Gates
TELLEVEL Bin Level Controls
Water Intake Screens
SEALMASTER Ball Bearing Units

Write for a bulletin on any of the above

STEPHEN S-A ADAMSON MFG. CO.

5 Ridgeway Avenue, Aurora, Illinois — Los Angeles, Calif., Belleville, Ontario

ESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

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Operate Overhead Valves From the Floor with...

Babbitt
Adjustable
SPROCKET RIM
with Chain Guide

Place your valves exactly where they belong, for most efficient and economical steam distribution. Operate them right from the floor — without special stairs, catwalks or balconies, or costly detours of overhead piping to floor level. Low-cost Babbitt Adjustable Sprocket Rim with Chain Guide brings every overhead valve within easy reach!

- Cuts piping costs
- Prevents accidents
- Saves fuel & steam

Range of 10 adjustable sizes fits all valve wheels from 2 to 30 inches diameter, with rising or non-rising stems. Only four simple, quickly-assembled parts.

Call your Industrial Distributor. He carries complete stocks. Or write for descriptive folder and prices.

Babbitt STEAM SPECIALTY CO.
2 BABBITT SQUARE, NEW BEDFORD, MASS.

More POWER NEWS

Begins on page 154

First 100 kw Wind Generator

LONDON — (McGraw - Hill World News)—The first wind-driven generating station is soon to be added to the British Electricity Authority's system. Preliminary trials under light inland breezes are to take place this summer at a site near St. Albans, Hertfordshire, north of London. This is a step further in BEA's effort to overcome the acute shortage of electricity and at the same time to save precious coal.

The new generator works on the depression principle, an arrangement whereby the generator is directly coupled to an air-turbine, both being at or near ground level and neither being mechanically connected to the propeller. The propeller, by extracting air from the system, sets up a pressure difference across the turbine sufficient to cause rotation.

The pitch is adjusted automatically by a hydraulic system so that the rotational speed is maintained constant when the wind speed is in excess of 30 mph and not more than 65 mph. Diameter of the swept circle is 80 ft. The propeller operates down wind of the tower.

The electrical equipment comprises one 100 kw, 415 volt, 3-phase, synchronous induction generator with exciter, which is started from rest as an induction motor. When synchronous speed is approached, direct current is fed into the field causing the generator to operate as a synchronous motor running under no load conditions. Air is then admitted to the turbine which in turn drives the motor in synchronism with the connected system. Fully automatic control gear is connected to the generator by flexible armoured cables.

Mining progress is pictured in a new **Gardner-Denver** movie entitled *Pay Dirt*. It dramatizes the improved techniques which mining men and mining equipment manufacturers have developed for producing greater and greater tonnages of iron, copper, uranium, zinc, nickel, lead, and all the other minerals which are used so abundantly today. It shows, for example, the strenuous hand drilling methods practiced years ago, followed by scenes of miners using early compressed air powered rock drill models, and then the newest high speed automatic drilling equipment.

Pay Dirt is a 16-mm. sound, color film that runs for about 30 minutes. It is one of a number of films on construction and mining subjects which are available from the Gardner-Denver film library, at no cost. Copies of these films may be obtained from Gardner-Denver Co, Quincy, Illinois.

Performance is PROOF

A large filtration plant Superintendent has this to say,

"For coagulation of high turbidity with a high PH we have found Ferric Sulphate to be superior in all cases and we would not hesitate to recommend it."

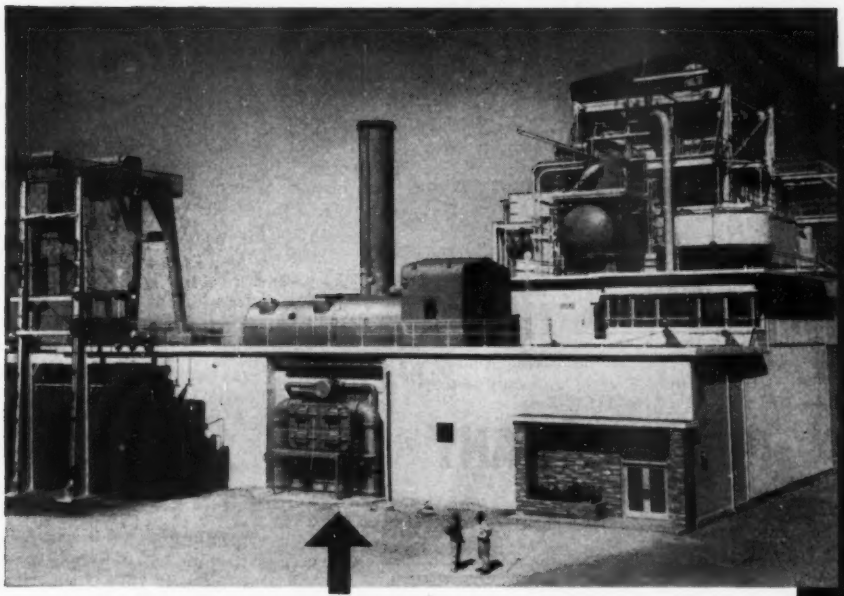
TENNESSEE CORPORATION
Ferri-Floc
FERRIC SULPHATE

Ferric Salts have proven their ability to coagulate waters of widely varying turbidity. Spring rains bring about turbidity for those who must treat surface supplies. The use of Ferri-Floc will simplify the treatment of this high turbidity. Ferri-Floc is partially hydrated Ferric Sulphate that has the ability to convert these high turbidities without radical dosage changes.

FREE LITERATURE—Let us send you without cost, our new booklet on economical and efficient coagulation. Just send a card or letter to Tennessee Corporation, Grant Building, Atlanta, Georgia.

TENNESSEE CORPORATION
617-29 Grant Building, Atlanta, Georgia

Salt River Power District Installs I-R Rectangular Condensers in unique, outdoor-type steam plant



NEW KYRENE POWER PLANT, designed to take advantage of Arizona climate conditions, saves valuable under-turbine space with **Ingersoll-Rand Rectangular Condensers**

This 27,500 sq. ft. I-R Rectangular Condenser serves Unit No. 1, a 30/33,000 kw turbine-generator, at the new Kyrene Steam Plant of the Salt River Power District.

The new Kyrene Steam Plant, near Phoenix, Arizona, is the latest addition to the Salt River Power District's combined steam, hydro and diesel power generating system.

Designed and built by the Bechtel Corporation, the Kyrene Station differs from the conventional outdoor installation in that the maintenance shops and auxiliary equipment are under cover for the comfort and convenience of operating personnel. All other elements of the station are of the outdoor type resulting in maximum economy of construction for the Arizona climate.

Unit No. 1—a 30/33,000 kw turbine-generator with throttle conditions of 850 psig, 900F—is supplied by a 350,000 lb. per hr. steam generator, designed to burn natural gas automatically, fuel oil manually, or coal or lignite on conversion. The turbine is served by an Ingersoll-Rand Rectangular Condenser containing 27,500 sq. ft. of cooling surface. Condenser cooling water is handled by two I-R vertical pumps handling 25,800 gpm. Condensate is handled by I-R vertical pumps.

Unit No. 2, now under construction, will have a rating of 60/66,000 kw. It will be served by a 47,500 sq.ft. I-R Rectangular Condenser, also of two-pass and vertically divided design. The condensate and circulating pumps will again be supplied by Ingersoll-Rand.

These Ingersoll-Rand Condensers save valuable space because their *rectangular design* makes the most efficient use of the rectangular space available below the turbine. And installation cost is minimized because they are completely assembled in the shop, then shipped in large sections, completely flanged for easy erection without any field fitting or strength welding.

Ingersoll-Rand

868-4 11 BROADWAY, NEW YORK 4, N. Y.

COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • DIESEL AND GAS ENGINES

DIESEL-POWERED TOW BOATS *Rely Upon* VIKING ROTARY PUMPS

Engine room of the George T. Horton, diesel-powered river tow boat, of the John I. Hay Co., Chicago, which can tow 200 freight cars up stream. Left front, Viking two-way lube oil pump.

Vital lubricating oil is delivered to bearings of two diesel engines with Viking automatic reversing lube oil pumps, whether tow boat moves forward or in reverse. The pumps derive power from crankshafts of engines and operate in both directions. This exacting job requires dependable pumps and Vikings deliver satisfaction.

Your pumping problem may call for the Viking rotary pumping principle—"a gear within a gear" and only two moving parts. For descriptive bulletin 53SW write

VIKING PUMP COMPANY
Cedar Falls, Iowa

THE ORIGINAL "*GEAR-WITHIN-A-GEAR*" ROTARY PUMP

Changing Address?

- If you are planning to move, please be sure to let our Circulation Department know about it — and as far in advance as possible.
- It takes time to correct the stencil addressing plate and to make the correction on all our records. So your prompt notification will help us make sure you do not miss copies of POWER.
- Be sure to give us your OLD address as well as your NEW address. We need them *both* to make the correction.
- Mail in the coupon if you plan to move. And please fill it in as completely as possible.

THANK YOU!

Circulation Dept.
POWER
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New York 36, N. Y.

Change of Address Notice
(PLEASE PRINT)

On or about .....

my NEW address will be . . .

Street .....

City ..... Zone .....

State .....

My OLD address was . . .

Street .....

City ..... Zone .....

State .....

.....

Name Here

More POWER NEWS

Begins on page 154

17 Years of Sea Water Testing

The corrosion testing station at Kure Beach, near Wilmington, N. C., was established by The International Nickel Co in 1935 for the immediate purpose of comparing sea water corrosion resistance of low alloy steels with carbon steel. Soon other materials were added to the program so that eventually comparative tests were being made on all kinds of ferrous and non-ferrous metals and alloys.

In 1940, facilities for exposing specimens to atmospheric attack were added. The atmospheric test lot is one acre in area and has room for 40 racks, each of which will support from 700 to 900 specimens. At the present time, the number of specimens exposed in the atmospheric tests is over 20,000.

The number of specimens now exposed in sea water is over 2,500 and, during the past 15 years, the number so tested has been over 15,000. All of this testing has been essentially a cooperative effort, involving Inco and producers and users of materials and coatings.

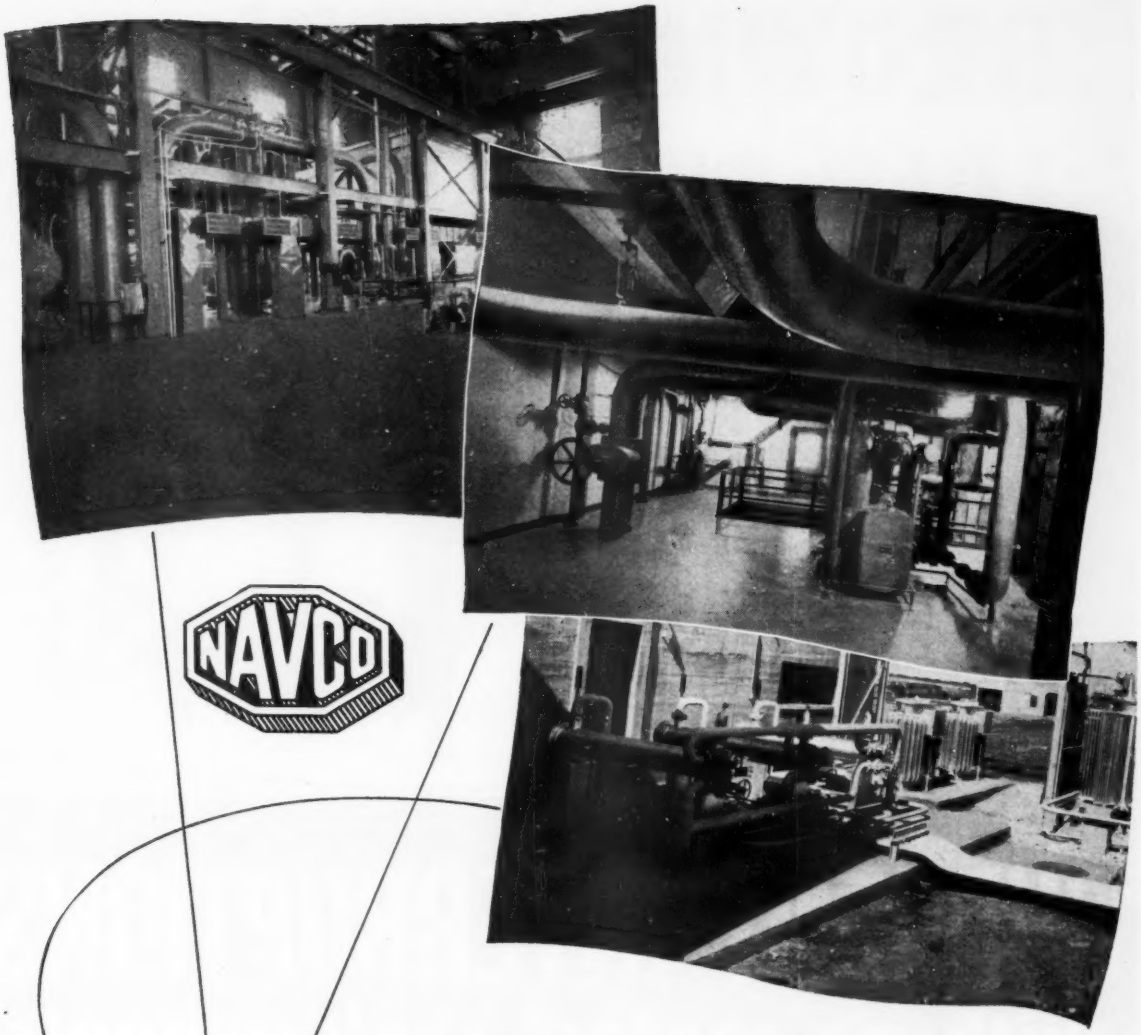
In the sea water tests, most specimens are exposed on racks continuously immersed at a depth of from 3 to 4 feet. Facilities have been provided also for hanging specimens from a large pontoon float when it is necessary to maintain a constant water line or a constant depth of immersion in spite of the rise and fall of the water with the tides.

The period of exposure of a group of specimens may vary from 6 months to several years—the longest to date being 12 years.

Inco's industrial motion picture, *Corrosion In Action*, was filmed principally at Kure Beach and Harbor Island. This film is available on request for showings before technical, industrial and educational groups by writing the company at 67 Wall St, New York 5, N. Y.

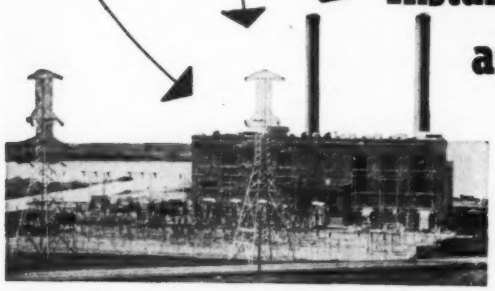
The General Electric Co supplied three 62,500 kw turbine-generator units and eleven power transformers in the ultra-modern Bokaro steam plant located 200 miles northwest of Calcutta, India, which was dedicated by Prime Minister Jawaharlal Nehru February 21.

The Bokaro steam plant is located in the Damadar Valley, the middle of India's mineral storehouse. Three fourth's of the country's coal deposits are located there, and the plant will use pulverized coal as fuel. Iron ore and bauxite are also mined, and the new plant will eventually supply power for smelters and other industrial projects.



NAVCO

Installations in Central Power Stations assure Absolute Dependability



FOR almost half a century Navco has specialized in the fabrication and erection of Piping Systems for the highest operating conditions.

The "first" base load Central Station Piping System operating at 1350 lbs. and 900° (back in '30)—the "first" carbon moly to be used in a complete Steam System of Central Station Piping—one of the "first" field x-rayed systems of Steam Piping and one of the "first" Piping jobs to serve a 1,000,000 lb. per hour boiler are among some of the many Navco installations.

Consult Navco for your next Piping job.

NAVCO PIPING

NATIONAL VALVE & MANUFACTURING COMPANY • PITTSBURGH, PA

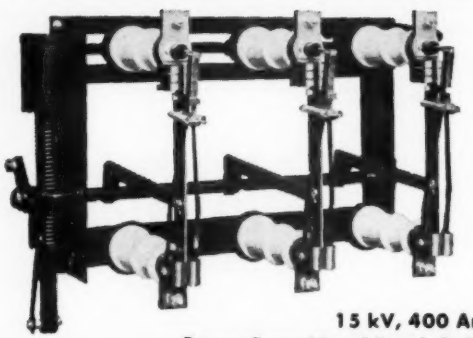
NEW YORK • CHICAGO • CLEVELAND • BOSTON • ATLANTA • BUFFALO • CINCINNATI

BROWN BOVERI LOAD BREAK SWITCHES

are guaranteed for

500 FULL CURRENT INTERRUPTIONS

with no contact replacements



15 kV, 400 Amp
Brown Boveri Load Break Switch

Designed for substation and branch line service, a Brown Boveri Load Break Switch requires no outside air supply. Its own switching movement generates the necessary compressed air to quench the arc and eliminate scorching of contacts . . . hence, no danger of fire, explosions or fumes.

WRITE FOR DATA—MAIL COUPON TODAY

Brown Boveri Corp., 19 Rector St., N. Y. 6

Please send me complete data on Load Switches.

Name_____ Title_____

Company_____

Address_____

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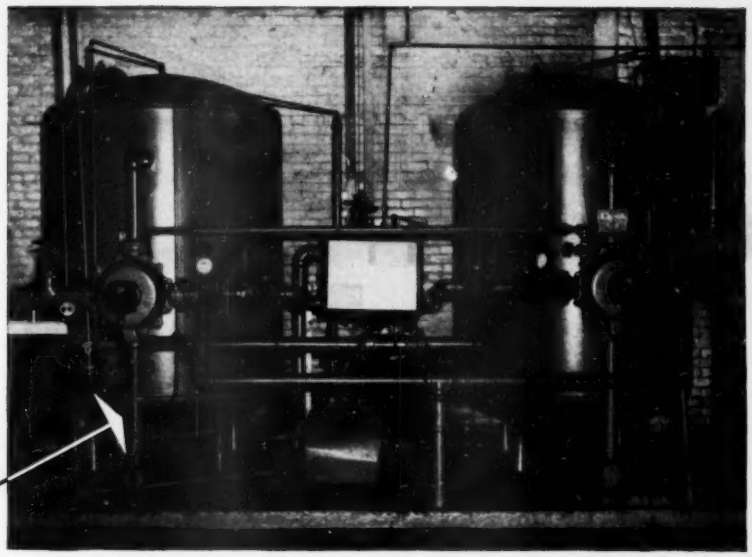
High Operating Speed—High Breaking Capacity. These switches are available for 7.5 kV, interrupting 10,000 kVA; and 15 kV, for interrupting 15,000 kVA. They will handle magnetizing and line charging currents without restrikes. Primarily supplied for indoor service, they are also available in a steel housing for outdoor operation.

BROWN BOVERI

BROWN BOVERI CORPORATION
19 RECTOR STREET, NEW YORK 6, N. Y.

You'd never guess

...to look at it...



...that this softener is delivering over 44% more soft water per regeneration than conventional softeners of the same size...

But it's a fact... because it's an Elgin!

ORDINARY DESIGN

ELGIN DESIGN
(Same size units; same type zeolite)

YES, Elgin is the only softener that gives you "Double-Check" Design and the increased capacity that goes with the "Double-Check". Glance at the diagrams which point out the big basic difference. By preventing the escape of zeolite, the "Double-Check" design permits a deeper zeolite bed; better back-washing; higher efficiency.

Remember: We can rebuild your present softener — *any make* — applying the "Double-Check" equipment needed to give greatly increased softening capacity. For facts call your nearest Elgin representative — or write for catalog.

ELGIN SOFTENER CORPORATION

130 GROVE AVE., ELGIN, ILLINOIS

ELGIN
SINCE 1908
WATER CONDITIONING FOR EVERY NEED

WHAT MUST YOU HAVE

... IN POWER PIPING?

Above all other things, you must have CONFIDENCE in it.

Confidence can't be purchased—it is acquired only through complete belief in the pipe fabricator's skill, facilities, technical knowledge . . . and *experience.*

P. P. & E. has been fabricating all types of high-pressure, high-temperature piping for central stations, paper mills, process and industrial plants for almost half a century. The importance of this experience, to you, is its great value in avoiding errors of omission and commission which can result in inefficiency, damage to expensive equipment, and dangerous operating conditions.

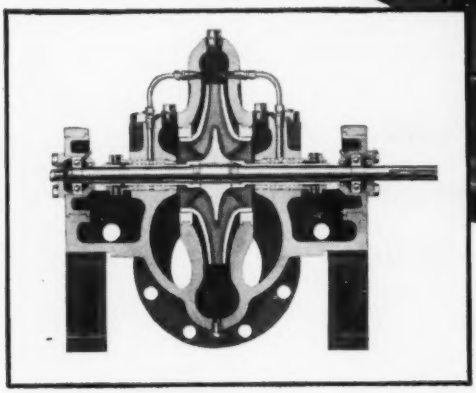
When P. P. & E. does the job, utmost care is taken to evaluate and interpret specifications correctly, and to comply strictly with code and insurance company requirements. Highly specialized shop facilities for bending, welding, Van Stoning, machining, heat-treating, testing, and inspection have been developed, and are operated by skilled workmen under competent supervision. A trained field organization directs the installation of complete systems, extensions, or alterations to existing layouts in any part of the country.

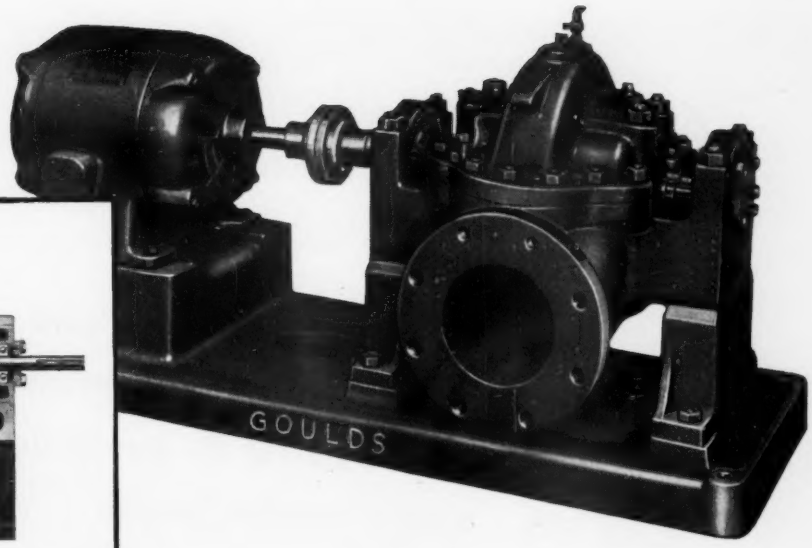
OFFICES IN OTHER CITIES:

Atlanta.....Whitehead Building	Houston..Heights State Bank Bldg
Boston.....10 High Street	New Orleans.....P. O. Box 74
Chicago....Peoples Gas Building	New York...Woolworth Building
Cleveland..Public Square Building	San Francisco..785 Market Street

Pittsburgh Piping
AND EQUIPMENT COMPANY
10 Forty-Third Street—Pittsburgh, Penna.

The new Goulds Fig. 3405 double-suction, single-stage, horizontally split casing centrifugal pump for general purpose pumping. 19 sizes. Capacities from 200 GPM to 6400 GPM. Heads up to 260 ft.





This new pump gives you 5 big cost advantages

The price you pay is only one element of the cost of a pump installation.

Good engineering practice also figures in the cost of pump breakdowns, low operating efficiency, change-overs to meet new conditions, replacement parts inventories, even the floor space the installation takes up.

Here's why the new Goulds centrifugal pump is designed to improve your cost experience in every one of those elements.

1. ***It combines seven design features that mean maximum operating efficiency and minimum maintenance.***

Every one of these construction features is standard with this new design. Together they offer you, without extra cost, a quality of service that's unique in its approach to general liquid handling.

a. Renewable stuffing box bushings.
b. Bearing housings sealed against moisture and dirt.
c. Cowl-type glands suitable for use with quenching liquids.
d. Stainless steel impeller keys.
e. Teflon water seal rings.
f. Die-formed stuffing box packing.
g. Corrosion resistant gland bolts.

2. ***Interchangeability of parts.***

With only three shaft and rotating parts assemblies to provide for 19 pump sizes and 38 pump combinations, this new design offers you a remarkable range of interchangeable parts. A glance at the interchangeability chart on page 7 of the descriptive bulletin will show you:

a. how this design gives you great flexibility in making field changes should your pumping requirements change;
b. why the first cost of this unit is so low due to standardization in manufacture; and
c. how this interchangeability helps to reduce spare parts inventories.

3. ***Compact construction.***

You will be particularly pleased with the short over-all length of this new design. Short bearing spans cut lengths as much as 50%. This means a real saving in floor space.

4. ***Flexibility of stuffing box.***

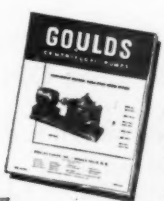
You can use either conventional stuffing boxes or mechanical seals depending on requirements. And you can change from one to the other in the field if need be.

5. ***Easy rotation change.***

A unique device, locking shaft sleeves, permits you to change from right-hand rotation to left-hand rotation or vice versa in the field without construction changes.

More than 50 years of experience in meeting industry's needs for general purpose centrifugal pumps come to a climax in this design.

GET FULL DETAILS **This 12-page illustrated bulletin, No. 721.6, covers the complete details of the new Goulds Fig. 3405, including specifications, interchangeability tables and performance curves. Be sure you have the whole cost-advantage story before you select another general purpose pump. Contact your nearest Goulds representative or mail the coupon below today.**



Goulds PUMPS INC.
Seneca Falls
New York

GOULDS PUMPS, INC., Dept. PO, Seneca Falls, N.Y.

Please send me Bulletin No. 721.6 describing the new Fig. 3405 centrifugal pump.

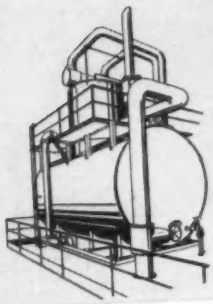
Name_____

Company_____

Address_____

City_____ State_____

This **10,000** lb. per hour PACKAGED DEAERATING HEATER



has the same design and performance characteristics as this 1,000,000 lb. per hour central station heater

Unlike the central station plant, the small steam generating plant must often function with little operating attention. That is the very reason why this plant should insist on equipment that will give dependable, fool-proof, 24-hour-a-day service with a very minimum amount of maintenance attention.

A well-designed deaerating heater in this plant protects the boilers, feedwater heaters, and condensate return lines . . . it must indeed be a rugged, dependable watchdog.

That's why Graver designed the packaged deaerating heater with the *same* materials of construction . . . design features . . . construction methods . . . workmanship . . . accessories . . . and guarantees . . . that are built into heaters for the largest power generating stations of 1,000,000 lb. per hr. or more.

In addition, these Graver Heaters are *standardized* in design . . . they are pre-engineered for quicker shipment and for lower cost of installation; and they are furnished as *packaged* units, with all necessary parts and accessories for speedy, easy installation.

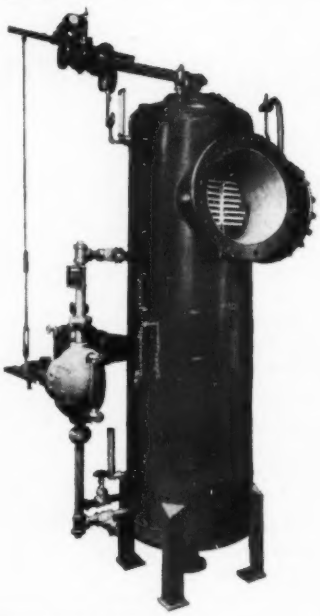
Write for descriptive brochure including dimensional and capacity data which will permit you to select the correct heater for your requirements.

GRAVER WATER CONDITIONING CO.

Division of Graver Tank & Mfg. Co., Inc.

Dept. P-H, 216 WEST 14th STREET, NEW YORK 11, N. Y.

In Canada: The Bird-Archer Co., Ltd., Cobourg, Ontario
In Mexico: Proveedores Tecnicos, S.A., Puebla 259, Mexico 7, D. F.



FEATURES OF GRAVER PACKAGED DEAERATING HEATERS

Spray or Spray-Tray Design . . . as best suited for particular plant conditions

Corrosion-Resistant Construction . . . vent condenser, spray valves and tray cubes of stainless steel

Internal Vent Condenser . . . avoids tube bundle cleaning, reduces weight and headroom

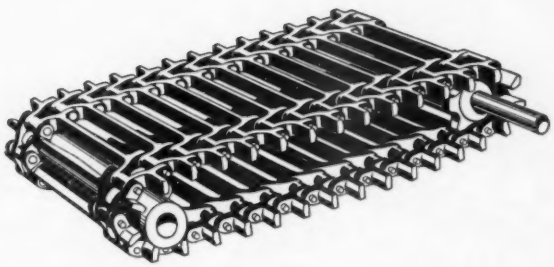
Self-Adjusting Spray Valves . . . highest efficiency at all loads, accessible from exterior

Tray Cubes . . . rugged construction, light weight, convenient size

Built in both vertical and horizontal types for capacities up to 100,000 lb per hr.

GRAVER ***Deaerating Heaters***

GW 472



The secret of no-clog feed for Perfect Spread

PERFECT SPREAD is the only STOKER available today that never clogs... not even on wet coal! And the secret of this remarkable efficiency is the exclusive American Engineering traveling conveyor feeder, pictured above, which employs a high traction principle and assures true, *continuous* feeding throughout its operating range of 50 to 7500 lbs. of coal per hour.

But in addition to no-clog feed, Perfect Spread Stoker gives you every other important feature... the special high-capacity spiral overthrow rotor which spreads coal over the whole grate so perfectly that it furnishes the stoker's name... the engineered cinder return and overfire air system that yield comparable results with both low and high ash coals.

Perfect Spread Stokers are made in a wide choice of sizes, capacities and grate types. Whether you are considering a new unit or restokering an old one, talk things over with your AE representative. It may lead to most steam at least cost.

AE

AMERICAN ENGINEERING

COMPANY

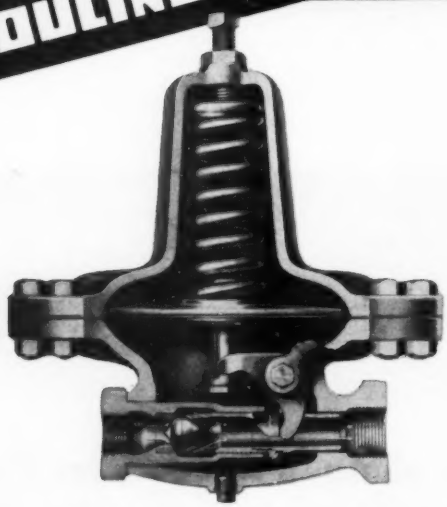
2400 ARAMINGO AVE., PHILADELPHIA 25, PA.

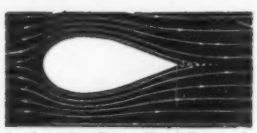
IN CANADA: AFFILIATED ENGINEERING CORPORATIONS, LTD., MONTREAL 2, CANADA

AE Products are: Taylor and Perfect Spread Stokers, Marine Deck Auxiliaries, Hele-Shaw and Hydramite Fluid Power, Lo-Hed Hoists, Lo-Hed Car Pullers.

HERE'S HOW PROCESSING LINES ARE *Fortified* AGAINST VALVE TROUBLES

CASH STANDARD *Streamlined* PRESSURE REDUCING VALVES TYPE 1000





Look at the Streamlined flow pattern directly above. It results because of the Streamlined form of the inner valve. On your lines it means smooth, dependable valve action day after day through years of service without attention. Proof of this is in what so many users say . . . "put the '1000' on the line and forget it."

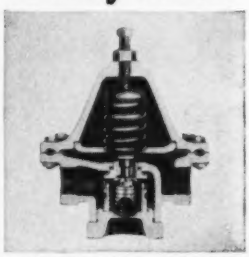
When you put this Streamlined construction on your lines you have no complicated parts to get out of order, no small ports or passages to clog up. There are no close fits. It's straight line flow all the way — flow that gives you maximum capacity, close delivery pressure control, and tight closures — flow that saves you money all along the line — flow that means elimination of failures — speedier production and no spoilage.

CASH STANDARD CONTROLS.. VALVES

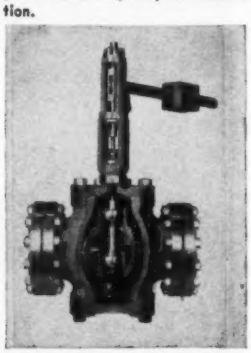
WRITE FOR BULLETIN 962

A. W. CASH COMPANY
DECATUR, ILLINOIS

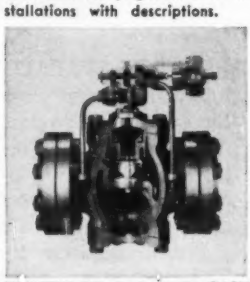
BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES
Send for them



BULLETIN 950—features the CASH STANDARD Type D Single Seat pressure Reducing and Regulating Valves for use with most fluids. Shows simple inner working parts that save in maintenance. Diagram explains how valve works. Blueprint shows simplicity of installation.



BULLETIN 965—features the CASH STANDARD "42" Series—a complete line of balanced lever valves for handling almost anything that will flow through a pipe except some injurious chemicals. Two full pages show 16 installations with descriptions.



BU. LETIN 967—features the CASH STANDARD Tye II Condenser Water Regulator — self-contained — pilot-operated for controlling the flow of cooling water to condenser coils. Used with water or air —with any gas or oil that is noncorrosive—and with all refrigerating fluids. Blueprints show installation at outlet of condenser and at inlet. Capacity charts are shown.

GLOBE

specialization gives you "Tops in Quality"

ALLOY STEEL TUBES

SEAMLESS — MECHANICAL — PRESSURE — CORROSION RESISTANT

TYPICAL ANALYSES:

Carbon	5 Chrome ½ Moly
Carbon ½ Moly	7 Chrome ½ Moly
½ Chrome ½ Moly	8 Chrome ½ Moly
1 Chrome ½ Moly	8 Chrome 1 Moly
1¼ Chrome ½ Moly	9 Chrome 1 Moly
2 Chrome ½ Moly	3% Nickel 7% Nickel
2¼ Chrome 1 Moly	5% Nickel 9% Nickel

AISI Types: 304-321-347-316-309-310-405-410-430-443-446

Analyses to meet conditions where heat, corrosion, pressure and structural strength are involved.

SIZE RANGE — WALL THICKNESS:

½ to 6 inches O.D. — wall thickness .035 to 1,000 inch.

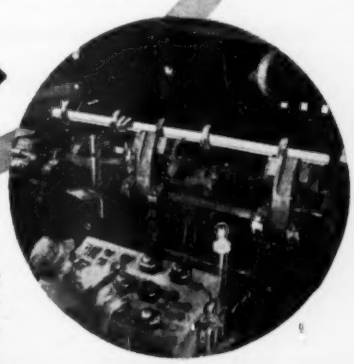
TYPICAL APPLICATIONS:

Pressure tubes — Superheater tubes — Condenser tubes — Still tubes — Evaporator tubes — Barrel tubes — Oil-well Pump Barrels — Mechanical tubes — Aircraft tubes — Propeller tubes — Rollers for Transmission Chains.

Globe engineers gladly give you the benefit of specialized knowledge of stainless steel tubing in a wide range of services and applications — to improve your product — to cut costs.

TO BE SURE . . . SPECIFY GLOBE

The heating, piercing, rolling of seamless tubes is controlled at every step for uniformity, close tolerance.



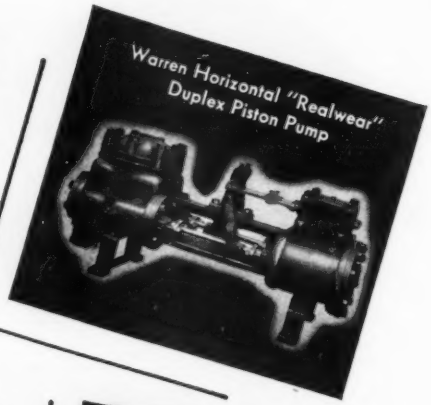
WHEN you specify Globe, you get uniform high quality alloy steel tubes, the product of highly developed production facilities and specialized quality controls and methods. All Globe tubes are thoroughly inspected and closely held within tolerance specifications. Write for the Globe general catalog.

GLOBE STEEL TUBES CO.

Milwaukee 46, Wisconsin Chicago • Cleveland • Philadelphia • St. Louis • New York Detroit • Denver • Houston • San Francisco • Glendale, Cal.

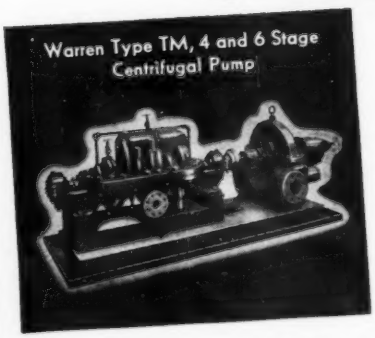
Producers of Globe seamless stainless steel tubes — Gloweld stainless steel tubes — alloy — carbon — seamless steel tubes — Globeiron (high purity ingot iron) seamless tubes — Globe Welding Fittings.

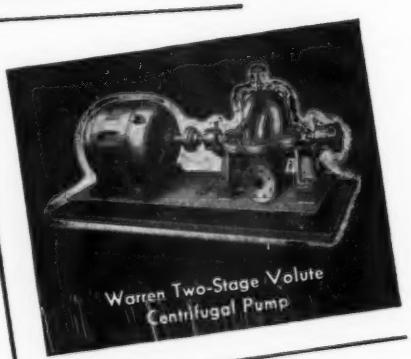
a boiler plant is no more dependable than its Feed pumps....



For well over half a century Warren has specialized in this field and has kept pace with boiler feed requirements as they have developed over the years.

As builders of both Centrifugal and Reciprocating types and for light, medium and higher pressure services, there is a thoroughly dependable Warren Pump to meet a very large part of all boiler feed conditions.
Their on-the-job record has long been one of reliable, low cost operation.





P-28

Time-Tested Experience Indicates it is Good Business

to Specify **WARREN PUMPS**

WARREN QUIMBY PUMPS

WARREN STEAM PUMP COMPANY, INC., WARREN, MASSACHUSETTS

Centrifugal . . . . . Reciprocating . . . . . Rotary

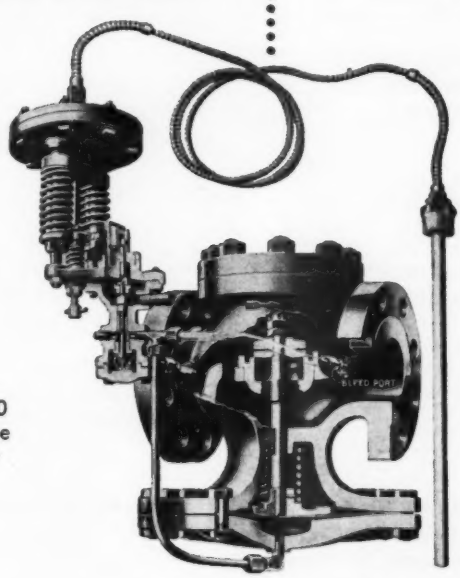
HOW SPENCE DESIGN...

...*protects springs*

FOR LONGER LIFE

In the Spence Regulator, the springs are out of the path of the steam or other fluid flowing through the valve. They operate at low unit stress for exceptionally long life. This is only one of the many Spence design features that assure dependable, accurate regulation year after year. That means less down-time, less time and money wasted on replacement of parts.

Spence makes a wide line of automatic regulating valves: Pressure, Temperature, Differential Pressure, Back Pressure, Pump Governor and many other types. Write for bulletin 100 giving full details.



Type ET150
Temperature
Regulator

A few other design features:

SECO METAL SEATS AND DISCS—Durable SECO Metal resists wiredrawing. More than twenty years of experience in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

LARGE BALANCED METAL DIAPHRAGM located in a cooled zone with a condensate seal above and below it, never has to be replaced under normal conditions.

PACKLESS CONSTRUCTION—All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . reduces valve stem wear and eliminates time-consuming maintenance.

Spence

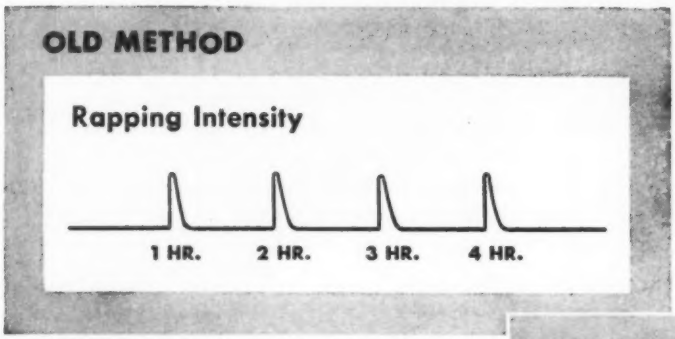
SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

SE123

New Development

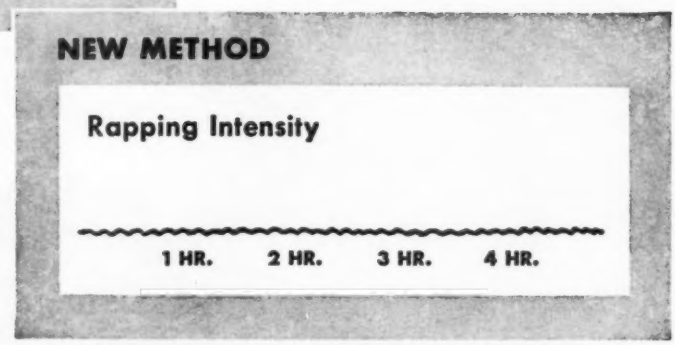
FOR ELECTRICAL PRECIPITATORS

ELIMINATES RAPPING PUFFS



Old Method of Rapping Resulting in Rapping Puff

Here are two simple diagrams that clearly demonstrate the importance of the new method of rapping developed by Research Corporation. The first shows the old way in which dust is shaken loose from electrodes at *periodic* intervals, causing intermittent puffs or clouding.



New Method of Continuous Rapping Eliminating Rapping Puffs
Rapping Intensity

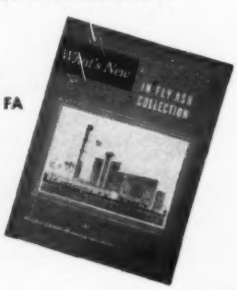
This second diagram illustrates the new scientific method of cleaning electrodes. It involves continuous or sequential rapping, every minute or less, at a controlled vibrational intensity. This converts precipitation from a batch operation to a *continuous and uniform process.*

This is another major contribution by Research Corporation to the field of electrical precipitation. Constant research and development work for the past 39 years has resulted in many other improvements over the first Cottrell Precipitator. These advances plus the unequaled experience gained through over 1000 installations, listed at right, assure you of a profitable solution to your specific problem.

RESEARCH CORPORATION INSTALLATIONS

55 Carbon Black Plants
208 Metallurgical Installations
215 Acid Plants • 34 Paper Mills
293 Detarring Installations
251 Power Stations
86 Steel Plants • 114 Oil Refineries
and Miscellaneous Installations

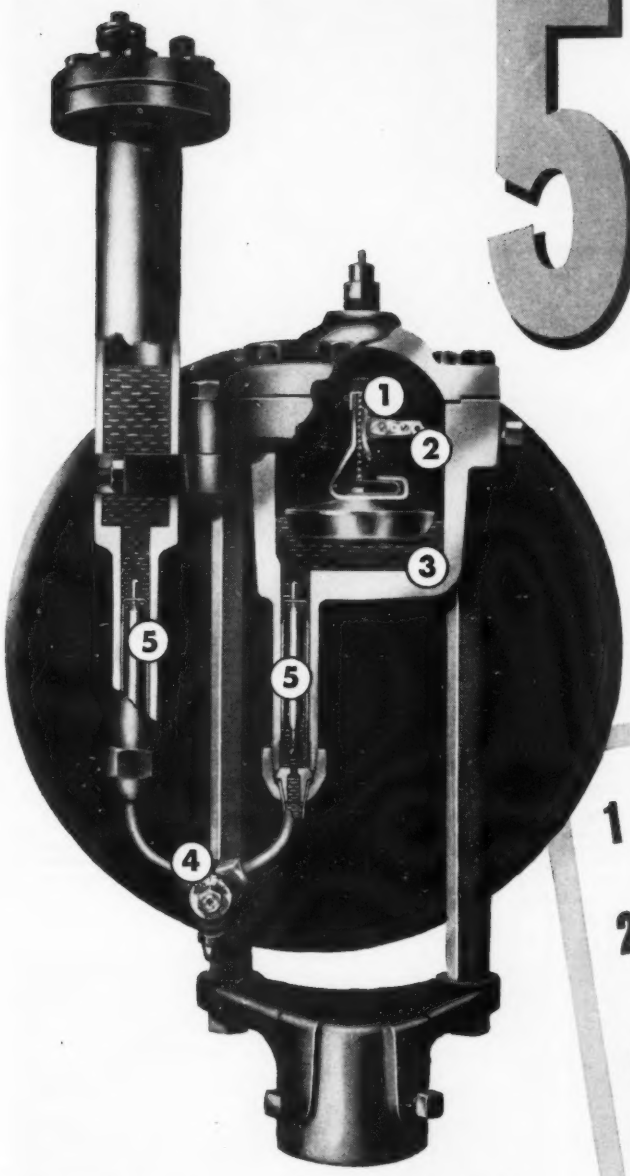
Want to know more about the new Rapping System? Bulletin FA contains additional data. Send for your copy.



RESEARCH CORPORATION

405 Lexington Avenue, New York 17, N. Y.
122 South Michigan Avenue, Chicago 3, Illinois
Bound Brook, New Jersey

RC-187



5 basic advances that mean BETTER FLOW METERING!

1 **New Segmental Drive Assembly** — stainless steel ball-type chain insures perfect alignment and friction-free travel of float.

2 **New Pressure-Seal Bearing** — stainless steel with exclusive seal ring . . . gives unmatched freedom at any working pressure from friction, maintenance and leaks. No lubrication required.

3 **New Compact Float Chamber** — greater accessibility for easier, quicker cleaning.

4 **New U-Bend and Damping Plug Assembly** — self-aligning, all-welded construction . . . no gaskets required. Calibrated damping plug fully adjustable under pressure. Directed drain for mercury at lowest point.

5 **New Check Floats** — with positive-seating stainless steel ball plug. Submerged in mercury for complete protection against dirt and corrosion.

With major improvements in every basic detail, the complete new line of Foxboro Flow Meters now gives metering performance that's farther ahead of the field than ever before!

In addition to the outstanding advances illustrated, these new meters incorporate many other superior features, including: interchangeable parts; large floats with long travel for added power; and float in high pressure chamber to minimize ambient temperature effects.

Write for new Bulletin 460. It describes the complete new line . . . indicators, recorders, controllers, transmitters . . . with round or rectangular cases . . . with and without integrators. The Foxboro Company, 685 Neponset Avenue, Foxboro, Mass.. U.S.A.

FOXBORO
Reg. U. S. Pat. Off.
First in FLOW METERS

FACTORIES IN THE UNITED STATES, CANADA AND ENGLAND

WHATEVER THE PUMPING JOB WHEN YOU SPECIFY "Buffalo" YOU'RE SPECIFYING SATISFACTION

(photo courtesy Washington Sunday Star)

Above, the 25' fountain produced by the No. 2 "Buffalo" SL Double Suction Pump bottom right, in Flower and Garden Show, National Guard Armory, Washington, D.C. Installation by Standard Engineering Company, Washington, D. C.

Bottom left, SL Pumps handling chilled water in a large air conditioning installation.

It isn't every day that a "Buffalo" pump is called on to create a 25-foot fountain for a Flower and Garden Show—in fact, probably 99.99% of our pumps feed boilers, handle paper stocks or chemicals or clear water in every conceivable application.

The point is, they do those jobs well, as users can tell you.

In the "Buffalo" line, you'll find:

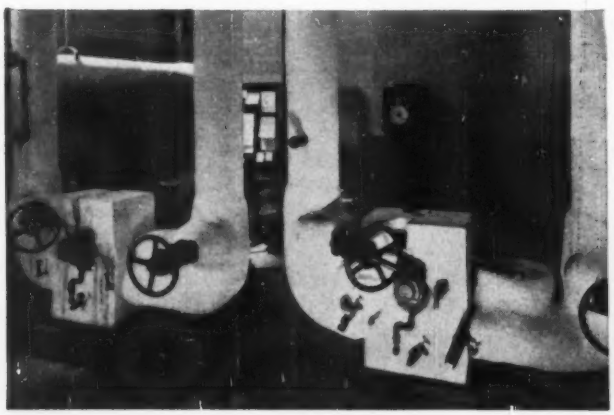
(1) *The RIGHT pump.* The line includes acid, rubber-lined, alloy, double-suction, single-suction, multistage, close-coupled, diagonally or horizontally split-shell, for almost any conditions.

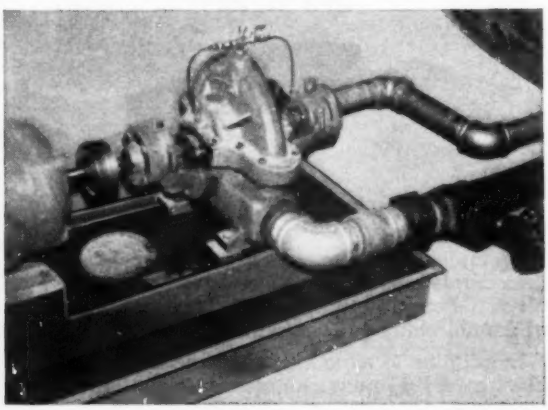
(2) *Efficiency—long life.* Impellers are husky, efficient enclosed type, and liquid passages are formed for least resistance.

(3) *Easy maintenance.* All parts are readily accessible, including impellers, stuffing boxes and bearings.

To be doubly sure that each "Buffalo" pump will perform up to specification on the job, it must pass a load test before shipment, duplicating the actual hydraulic conditions of the job for which it is intended.

Why not put a "Buffalo" Pump on your next job—for permanently satisfactory results? Write for details.





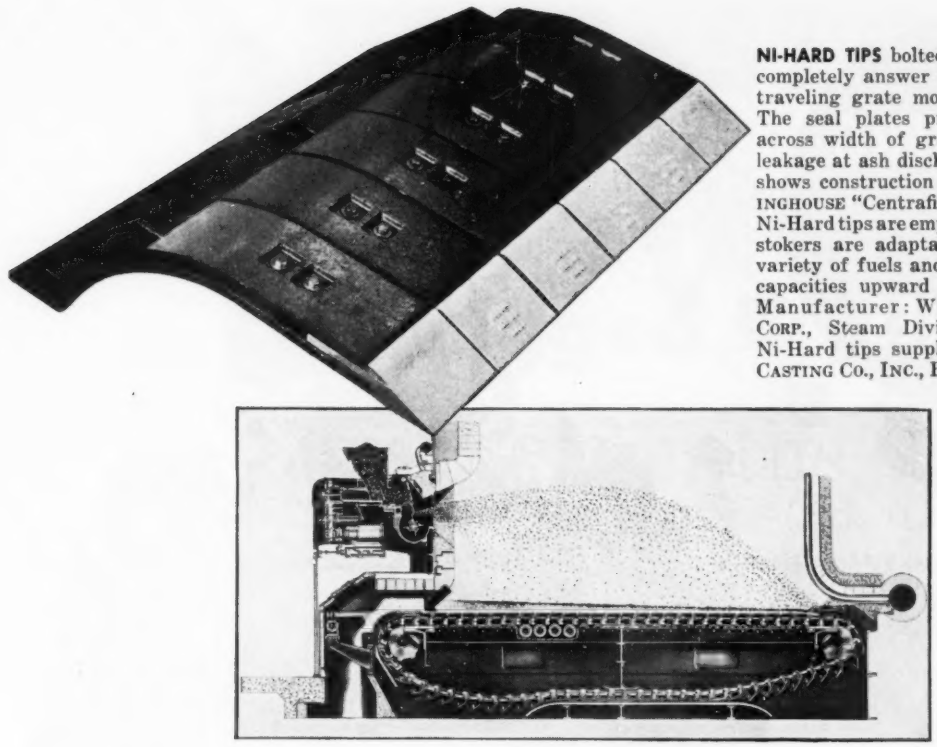
BUFFALO "Buffalo" PUMPS, INC.

488 BROADWAY BUFFALO, N. Y.

Subsidiary of Buffalo Forge Company

Canada Pumps, Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID



NI-HARD TIPS bolted to seal plate segments completely answer the abrasion problem as traveling grate moves from rear to front. The seal plates provide continuous cover across width of grate, thus preventing air leakage at ash discharge end. Cutaway view shows construction and operation of WESTINGHOUSE "Centrafire" stoker in which these Ni-Hard tips are employed (see arrow). These stokers are adaptable for burning a wide variety of fuels and are designed for steam capacities upward of 350,000 lbs. per hr. Manufacturer: WESTINGHOUSE ELECTRIC CORP., Steam Division, Philadelphia, Pa. Ni-Hard tips supplied by ABRASIVE ALLOY CASTING CO., INC., Bridgeboro, N. J.

WESTINGHOUSE

finds answer to severe abrasion problem

...SPECIFIES NI-HARD

NI-HARD® — the most abrasion-resistant product of the iron foundry — may help you in the same way it helps WESTINGHOUSE...

For this nickel-chromium white cast iron, with matrix structure similar to that of fully hardened steel, provides abrasion-resistance at lowest ultimate cost.

During the past twenty years, Ni-Hard has proven to be a money-saving replacement for white cast iron under all service conditions, and for carbon, alloy and manganese steels under conditions of moderate impact.

Investigate Ni-Hard. Learn how users are saving *money, time* and *labor* as a result of its extreme resistance to abrasion...

Send us details of your abrasion problems. Our years of practical experience in the Ni-Hard field can help you determine whether or not Ni-Hard will meet your particular needs.

At the present time, nickel is available for end uses in defense and defense-supporting industries. The remainder of the supply is available for some civilian applications and governmental stockpiling.

The International Nickel Company, Inc.
Dept. 20, 67 Wall Street, New York 5, N. Y.
Please send me free booklets entitled: "Engineering Properties and Applications of Ni-Hard" and "Buyers' Guide for Ni-Hard Castings."

Name..... Title.....

Company .....

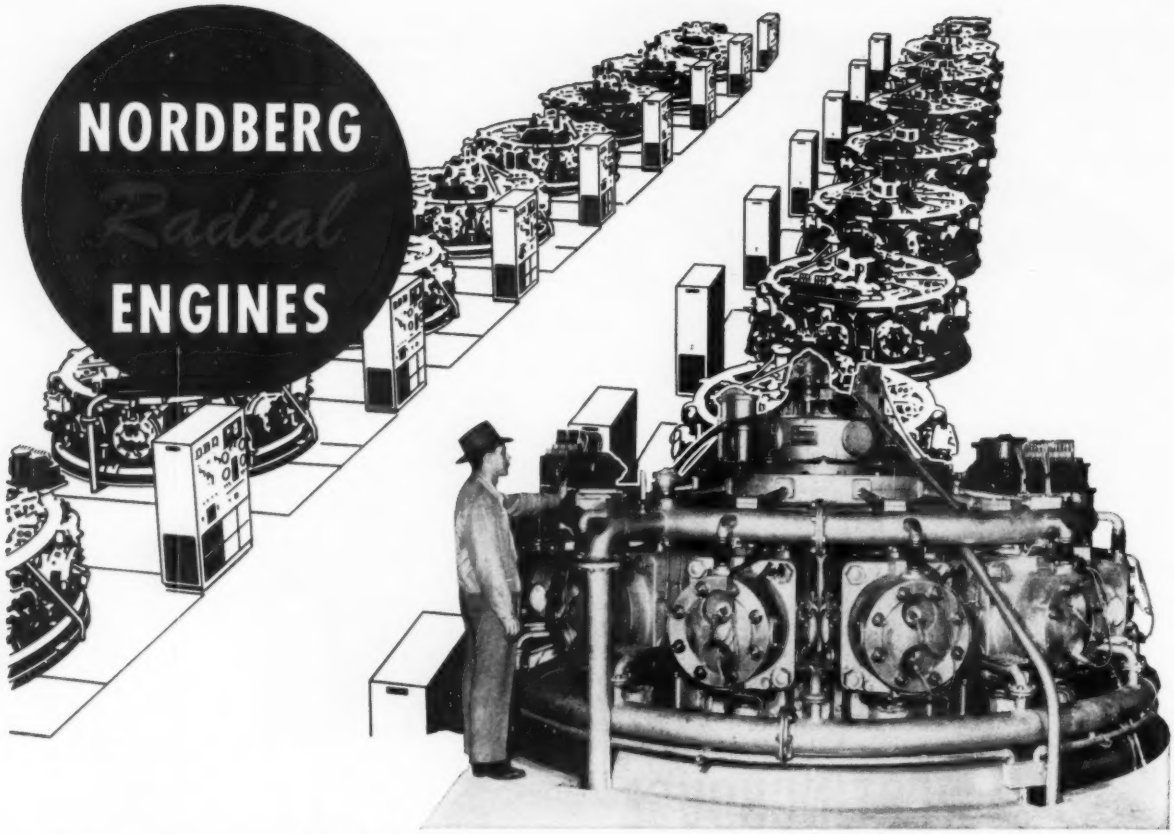
Address .....

City..... State.....

EMBLEM OF INCO SERVICE

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N.Y.

NORDBERG *Radial* ENGINES



Supply Reliable, Compact, Low Cost Power

• NORDBERG 2-CYCLE RADIAL ENGINES develop 1950 to 2125 hp. or 1250 to 1500 kw. at 400 rpm.

Applicable for municipal and industrial power plants and central stations . . . wherever compact, economical, dependable power is required. *For full details, send for Bulletin 200.*

NORDBERG Radial Engines (*Diesel, Duafuel® —Spark-Fired Gas*) offer an unusual combination of design and operating advantages which make them ideally suited for continuous heavy duty power service. *Compare these basic advantages:*

☆ MORE POWER—LESS SPACE ☆ MINIMUM MAINTENANCE

☆ LOW INSTALLATION COST ☆ PROVEN DEPENDABILITY

☆ LOW OPERATING COST ☆ SMOOTH, BALANCED OPERATION

☆ SHIPPED AS A COMPLETE UNIT

NORDBERG MFG. CO., Milwaukee, Wisconsin

NORDBERG

DIESEL • DUAFUEL® AND SPARK-FIRED GAS ENGINES

P453-R

UNIBESTOS®

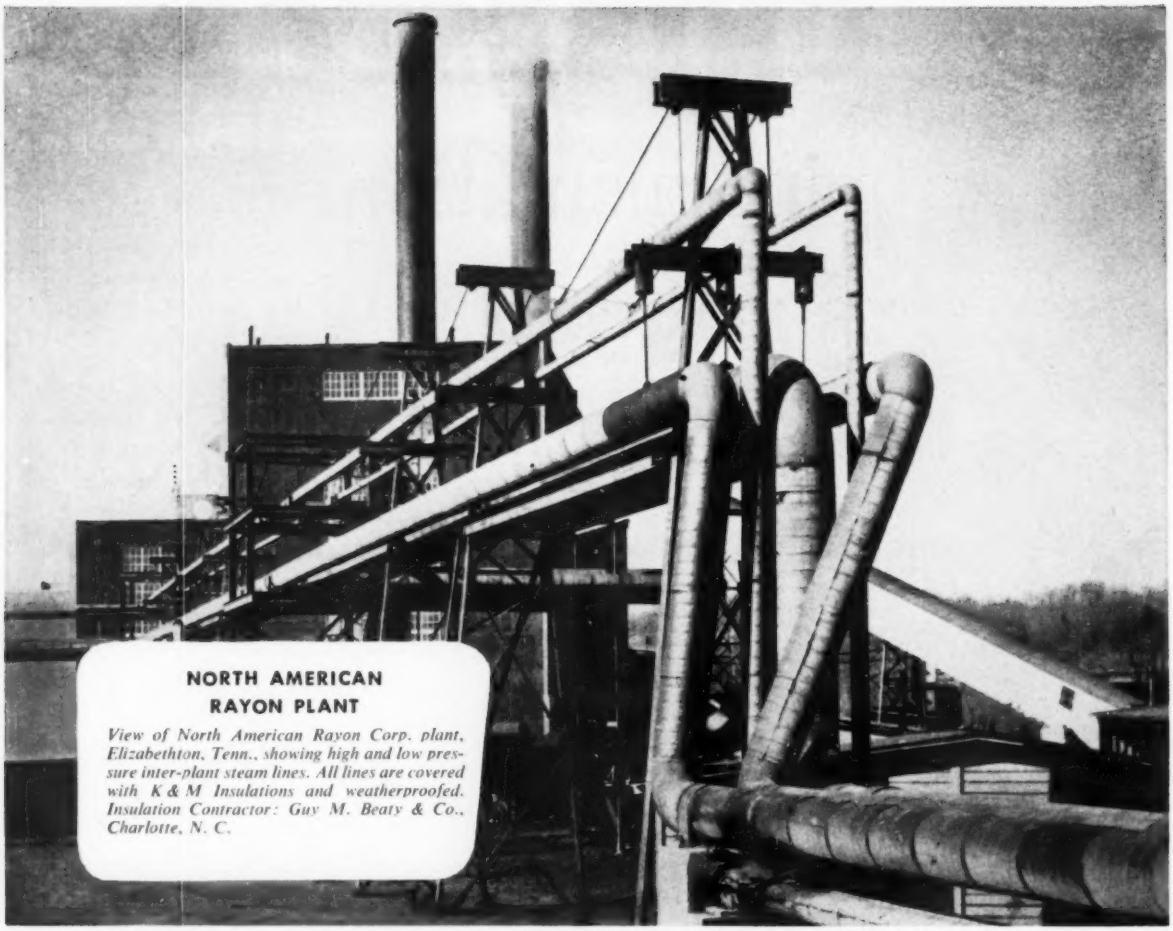
pipe insulation is **rugged** It stays on the job

A NECESSITY ON MANY JOBS • A PLUS VALUE ALWAYS

UNARCO

UNION ASBESTOS & RUBBER COMPANY

Dept. C-5, 332 SOUTH MICHIGAN AVENUE, CHICAGO 4, ILLINOIS



NORTH AMERICAN RAYON PLANT

View of North American Rayon Corp. plant, Elizabethton, Tenn., showing high and low pressure inter-plant steam lines. All lines are covered with K & M Insulations and weatherproofed. Insulation Contractor: Guy M. Beaty & Co., Charlotte, N. C.

Steam takes weather in stride
– under K&M Insulations!

THE steam lines pictured above run more than 2000 feet in the open air—exposed daily to sun, rain, and constant air-temperature change. Yet, because of efficient K&M Insulations, the steam travels these lines with minimum temperature loss. To the plant owners, that means power saved, money saved!

The two products that keep this heat within bounds are K&M Hy-Temp Insulation and "Featherweight" 85% Magnesia. Hy-Temp (diatomaceous silica) has exceptional heat-resisting qualities, and is put directly on the hot surface. A sufficient thickness brings its outside surface temperature to 600°F. or lower.

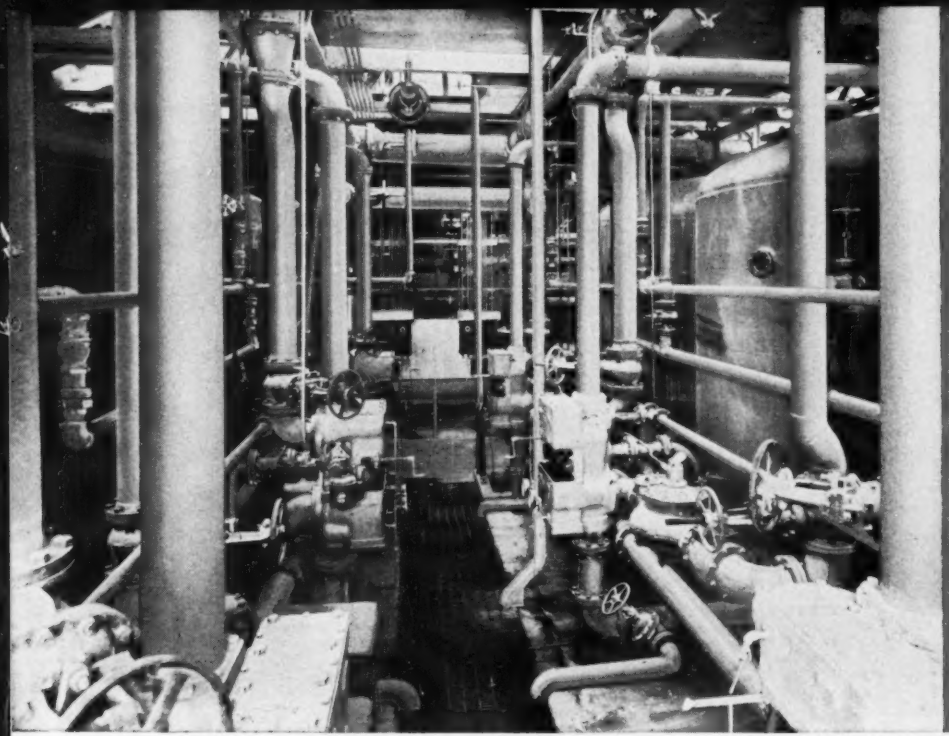
"Featherweight" 85% Magnesia, a superb insulator, is used as the second layer; and its surface may then be covered and painted, or weatherproofed for outdoor service, as in the illustration above.

K&M Hy-Temp and "Featherweight" in combination are effective on applications up to 1900° F. Two separate layers of insulation with vertical and horizontal staggered joints eliminate heat loss which occurs when expansion of hot piping and equipment causes joints to open in single layer installations. Both materials are made in a variety of sizes, shapes, and thicknesses to suit any application.

Your K&M Distributor is an experienced applicator who will gladly tell you more about these products. Or write directly to us.

KEASBEY & MATTISON
COMPANY · AMBLER · PENNSYLVANIA
In Canada: ATLAS ASBESTOS COMPANY, LTD., MONTREAL, TORONTO, WINNIPEG, and VANCOUVER

Nature made Asbestos... Keasbey & Mattison has made it serve mankind since 1873



CAST IRON

WELDED STEEL

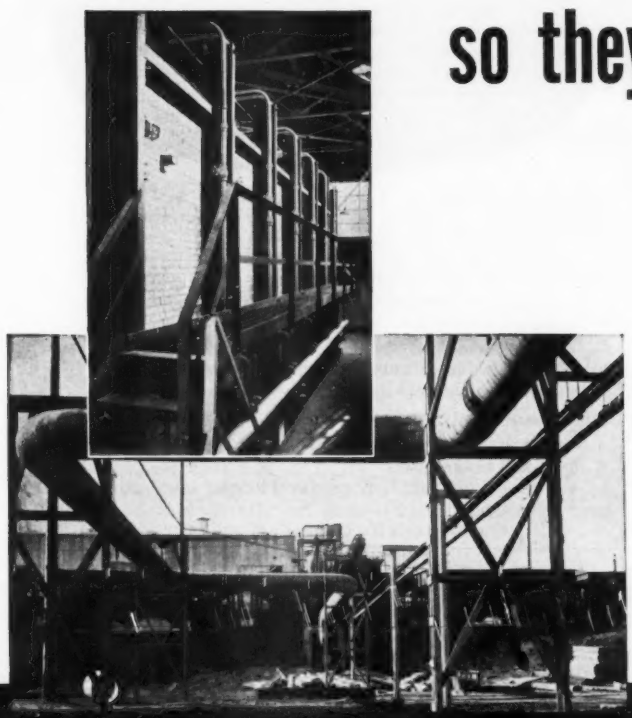
MONEL METAL

STAINLESS STEEL

PLASTIC LINED

A critical piping job...

so they called in Blaw-Knox



Piping requirements for this "classified" processing plant were most unusual. To handle highly corrosive fluids, gas, steam, water and air called for a wide range of metals and fabricating techniques. Space limitations, too, complicated the installation, demanding extreme accuracy in contour and dimension.

Power Piping Division's superior plant facilities, exceptional field organization and top-notch experience accounted for... "a good job, well done."

BLAW-KNOX

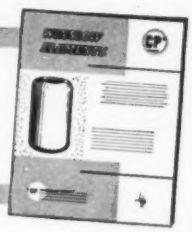
BLAW-KNOX COMPANY
POWER PIPING
AND SPRINKLER DIVISION
PITTSBURGH 22
PENNSYLVANIA

BLAW-KNOX

what does "CP" mean to you?

"CP" means Winslow Controlled-Pressure Elements, with an exclusive built-in system enabling *all* of your lubricating oil, *hot or cold*, to get full-flow filtration, even under *contaminated* element conditions. For this patented protection, look only to Winslow "CP" Elements.

"CP" TRADE MARK



WRITE FOR FREE FOLDER!
Get a complete description of Winslow "CP" Elements. There are no charges or obligations. Just send us your request.

WINSLOW FILTERS

Winslow Engineering Company 4069 Hollis St., Oakland 8, Calif.

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VALVES

INDUSTRIAL • CHEMICAL • AIRCRAFT

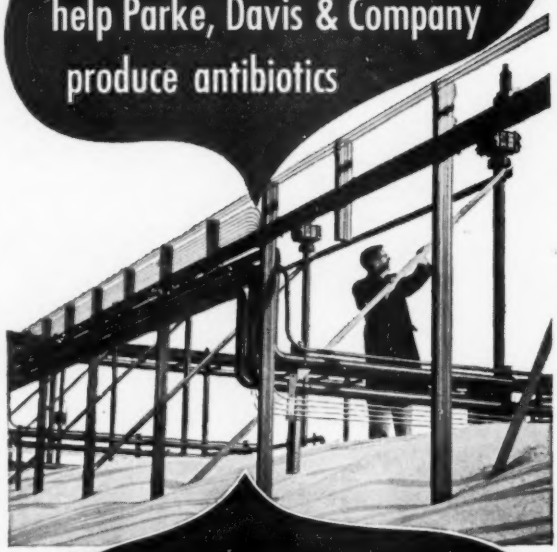
Remco Check Valves are sturdily built for either 500 psi or 3,000 psi hydraulic service—brass, aluminum alloy, steel, and stainless steel. Pipe, or AN or J.I.C. tube ends, or combinations. Sizes ⅛" to 1".

Manufacturers also of high quality globe, needle, relief, and 2, 3, and 4-way plug valves, and special valves to specifications.

Write for complete catalog and name of nearest distributor. 84

REPUBLIC MANUFACTURING CO.
1930 WEST 77TH STREET • CLEVELAND 2, OHIO

More than 4 miles of ALCOA Aluminum Tubing help Parke, Davis & Company produce antibiotics



ALCOA UTILITUBE—*more than four miles of it*—connects outdoor tanks with gages at Parke, Davis & Company's new Chloromycetin plant at Holland, Michigan—the world's only plant producing antibiotics by chemical synthesis. Alcoa's all-purpose aluminum coiled tube is used for instrument line service at this 124,000-gallon tank farm.

Alcoa Utilitube offers savings up to 40% over copper . . . has excellent on-the-job forming and flaring properties. It is available in economical, long lengths up to 1,000 feet or more, depending on size. It stands up well under vibration . . . has high resistance to most industrial atmospheres and to many liquids and gases.

In petroleum service, Alcoa Utilitube will not form sludge or gum . . . will not discolor or contaminate the fluid it carries.

Use Alcoa Utilitube for:

- Air for pneumatic and hydraulic control circuits and brake lines.
- Gasoline and fuel oil for internal combustion engines.
- Lubricating oils for engines and machines.
- Fluids for hydraulic systems.

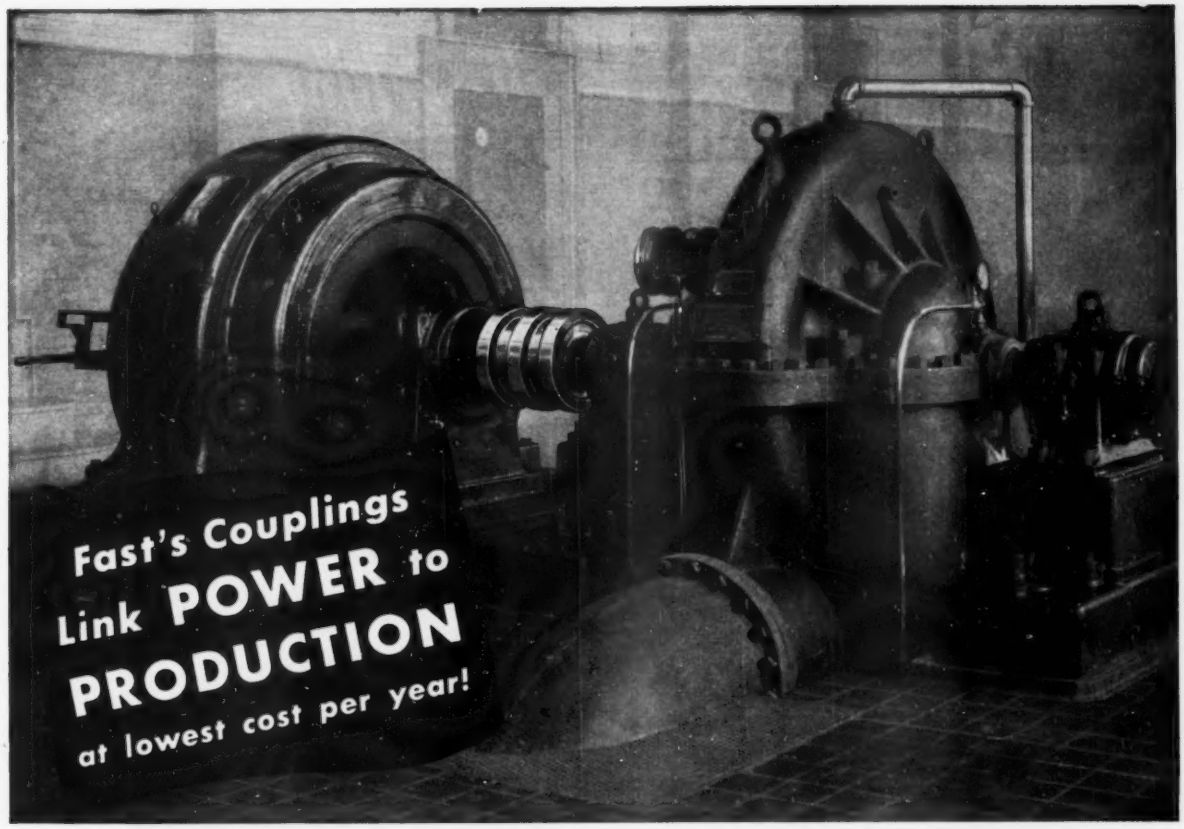
For complete details, write for the new booklet: "Alcoa Utilitube."

ALUMINUM COMPANY OF AMERICA
1004-E Alcoa Building, Pittsburgh 19, Pa.

Alcoa Aluminum

ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA



FAST'S Couplings usually outlast the equipment they connect!

ACTUAL cases on record show many Fast's Couplings are still in service after as much as 30 years of continuous operation! Time and time again, equipment has been replaced while the original Fast's Coupling remained on the job.

To you, these records of dependable, trouble-free service mean freedom from costly coupling failures when you specify Fast's. And they mean Fast's cost you far less to own and operate . . . because their cost can be amortized over long years of dependable performance.

For full details on how Fast's Couplings and Koppers Engineering Service can help you, write today for a free copy of our catalog to: KOPPERS COMPANY, INC., *Fast's Coupling Dept.,* 225 Scott St., Baltimore 3, Maryland.

Here's How FAST'S Save You Money

Free Service—Koppers free engineering service assures you the right coupling for the job.

Rugged Construction—Fast's still maintains its original design, without basic change or sacrifice in size or materials. Result: freedom from expensive coupling failures.

Lowest Cost per Year—Fast's Couplings usually outlast equipment they connect. Their cost may be spread over many years!

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FAST'S

THE ORIGINAL GEAR-TYPE

Couplings

INDUSTRY'S STANDARD FOR 32 YEARS

KOPPERS COMPANY, INC., *Fast's Coupling Dept.,*
225 Scott St., Baltimore 3, Md.

Gentlemen: Send me Fast's Catalog which gives detailed descriptions, engineering drawings, capacity tables and photographs.

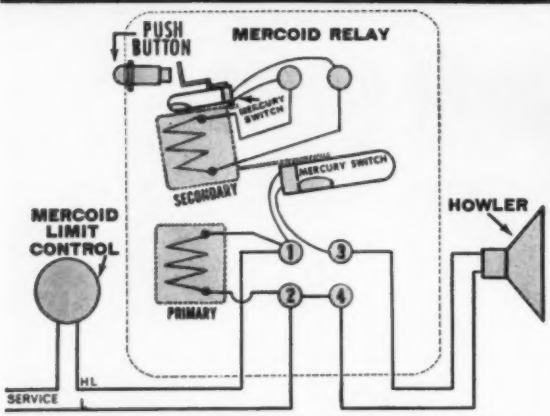
Name_____

Company_____

Address_____

City_____ Zone____ State_____

MERCOID RELAY FOR AUDIBLE ALARM

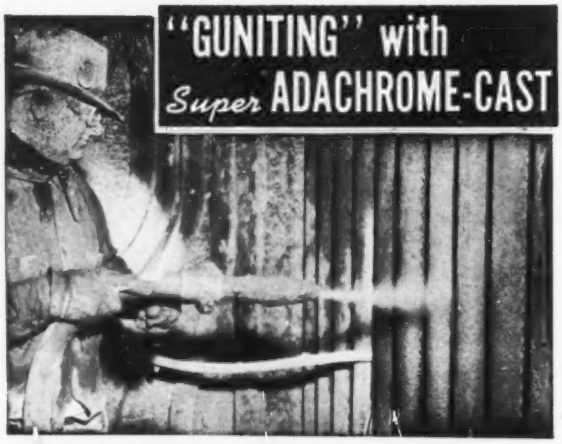


When Limit Control closes its circuit, current is supplied to primary coil of Mercoid Relay and through the normally closed mercury switch to the "Howler" (alarm). To stop "Howler," operator pushes in "push button" which manually raises relay secondary and breaks circuit to "Howler." Secondary is held up by magnetic repulsion until condition is corrected. When limit control opens the primary circuit of relay, secondary coil drops to normal position and relay is automatically ready for another operation.

WRITE FOR BULLETIN CA-8R

THE MERCOID CORPORATION, 4201 BELMONT AVE., CHICAGO, ILL.

"GUNITING" with Super ADACHROME-CAST



Tradename "Guniting" courtesy Cement Gun Co., Allentown, Pa.

...SAVES OUTAGE TIME and MONEY

Use SUPER ADACHROME-CAST to gunite your stud tube water walls.—Fine-grained to penetrate the small apertures between studs.—packs to a dense mass when shot. One user reports SUPER ADACHROME-CAST lasted twice as long and took but one-third the time to apply as compared with a plastic chrome ore installation.

Excellent for coating brickwork when free of slag.

Yours, *FREE* for the asking . . . an Illustrated, detailed Bulletin on *Super* ADACHROME-CAST.

BOTFIELD REFRACTORIES CO.

784 S. Swanson St., Philadelphia 47, Pa.
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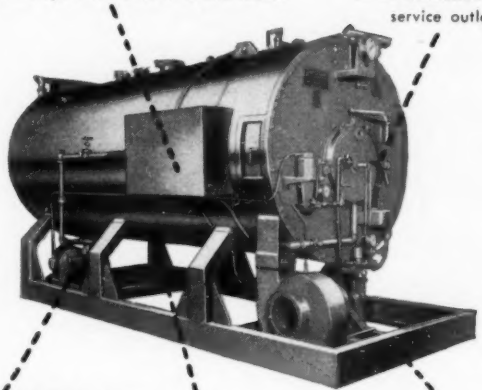
Here's Why... AMESTEAM GENERATOR Cuts Your STEAM COSTS

EYE-LEVEL CONTROLS and full automatic operation save time and labor.

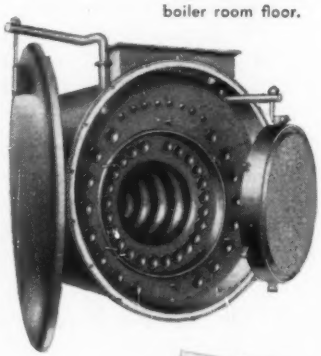
FULLY PIPED AND WIRED — needs only to be connected to service outlets.



COMPLETE UNIT with feed water pump, fan, condensate tank, refractories, insulation. Needs no expensive stack or brickwork!

EVERYTHING EASY TO GET AT! Look at the space underneath the shell!

REQUIRES NO SPECIAL FOUNDATION! Just set unit on boiler room floor.



HERE'S EASY CLEANING!

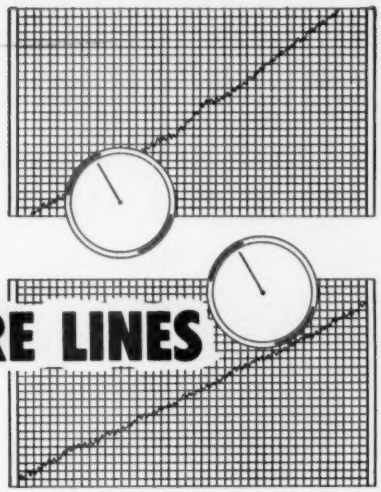
Rear flue cover and one-piece rear baffle are easily opened on davit-type hinges to expose furnace and all tubes — and there are ample clean-out doors in front end.

IF YOU WANT LOWER STEAM COSTS look into these compact units of 80% guaranteed efficiency. Write now for Bulletin 1050. 20 sizes, 10 to 600 h.p., 15 to 200#, to burn oil or gas. **WRITE TODAY!**

AMES IRON WORKS INC.

BOX I-53 OSWEGO, N. Y.

Builders of Better Boilers since 1848



For worry-free HIGH PRESSURE, HIGH TEMPERATURE LINES

you need that *Extra Margin of Safety* that *ONLY* Seamless provides!

WATCHING gages won't solve your problems. Nor lessen your responsibility as plant engineer for safeguarding equipment, and eliminating costly shutdowns that could result from the failure of your steam lines.

In dealing with today's mounting pressures and temperatures, you can have real peace of mind *only* when you have complete confidence in your power pipe and tubes. If you *know* that they are free from potential sources of weakness, you can face the severest operating conditions with assurance.

NATIONAL Seamless with its famous "Walls without Welds" has never been surpassed for power plant service. Pierced from a billet of high quality steel it has the strength, uniformity and dependability of a solid forging. Every length is an homogeneous steel cylinder. It has no welds, no line of potential weakness to limit safe operating pressures.

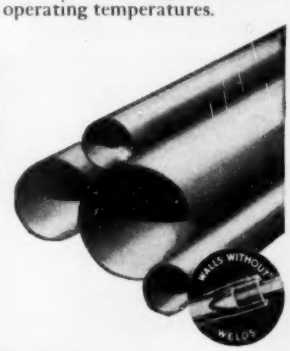
Made to the detailed requirements of recognized standard specifications and carefully tested and inspected before shipment, it comes to you structurally sound from end to end.

NATIONAL Seamless Pipe and Tubes promise smooth installation

Countless installations all over the country—many under the most severe operating conditions, are convincingly demonstrating the outstanding fabrication qualities of NATIONAL Seamless Pipe and Tubes. Power Plant Designers have found that when specifying NATIONAL for their power plant requirements it has the strength to meet any specifications; that it meets all requirements for flanging, bending, expanding, coiling, and similar purposes; that it is available in many grades of steel—from carbon to alloy steel and stainless—to assure maximum creep strength for actual or anticipated operating temperatures.

These FREE data books will help you

For more information about NATIONAL Seamless Pipe and Tubes for power plants, write for Bulletin Number 26 which contains interesting technical data concerning the properties of steels employed for elevated temperatures, and Bulletin Number 10 covering high-pressure power plant piping. Address your inquiry to National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.



NATIONAL TUBE DIVISION
UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
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Save time...

ENGRAVE your own NAMEPLATES

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World's Largest Manufacturer of Portable Engraving Machines

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Mercury Plunger Relays

FOR

2 and 3 POLE APPLICATIONS

- Hermetically Sealed
- Silent Operation
- Explosion Proof
- No Maintenance
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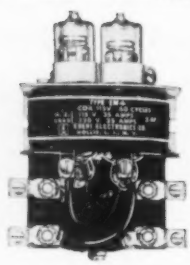

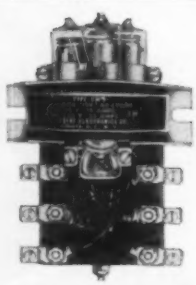

The many advantages of mercury plunger construction are now available in relays for 2 and 3 pole applications.

Compact size and high current handling capacity (up to 60 amps) permits realistic savings in cost and space. For complete details just ask for our free catalogue—and don't forget—our engineering division is ready to serve on any of your relay problems.

EBERT ELECTRONICS CO.
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6 Essential Facts

for a company with a Water Problem...

1. Costs Far Less to Install!

A Ranney Water Collector will add millions of gallons to your daily water supply—at a fraction of the cost of conventional systems!

2. Less Expensive to Operate!

A Ranney Water Collector is far less expensive to operate—uses fewer pumps, fewer personnel, less power, and usually requires no treatment facilities.

3. Maintenance Requirements Practically Nil!

A Ranney Water Collector requires little or no maintenance. The rate of flow through the Ranney Collector's apertures eliminates clogging and silting. No filter plant maintenance.

4. More Water per Unit!

A single Ranney Water Collector has produced more clear, cool water than ten conventional vertical wells.

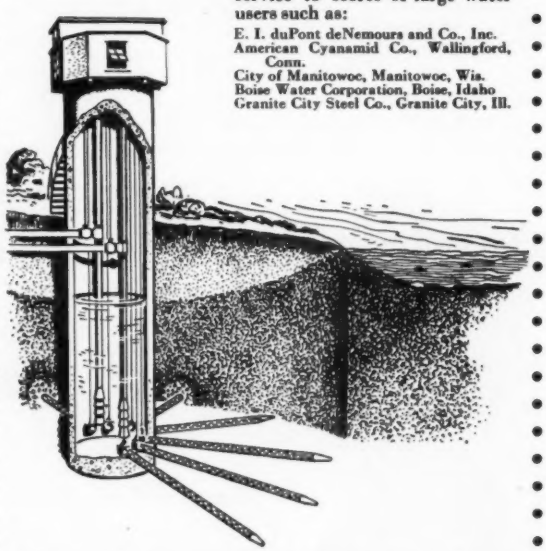
5. Far Longer Life Cuts Depreciation Costs!

The longer life of a Ranney Water Collector lowers financing and depreciation rates appreciably.

6. Ask These Satisfied Users

Ranney Water Collectors are currently rendering excellent service to scores of large water users such as:

E. I. duPont deNemours and Co., Inc.
American Cyanamid Co., Wallingford, Conn.
City of Manitowoc, Manitowoc, Wis.
Boise Water Corporation, Boise, Idaho
Granite City Steel Co., Granite City, Ill.



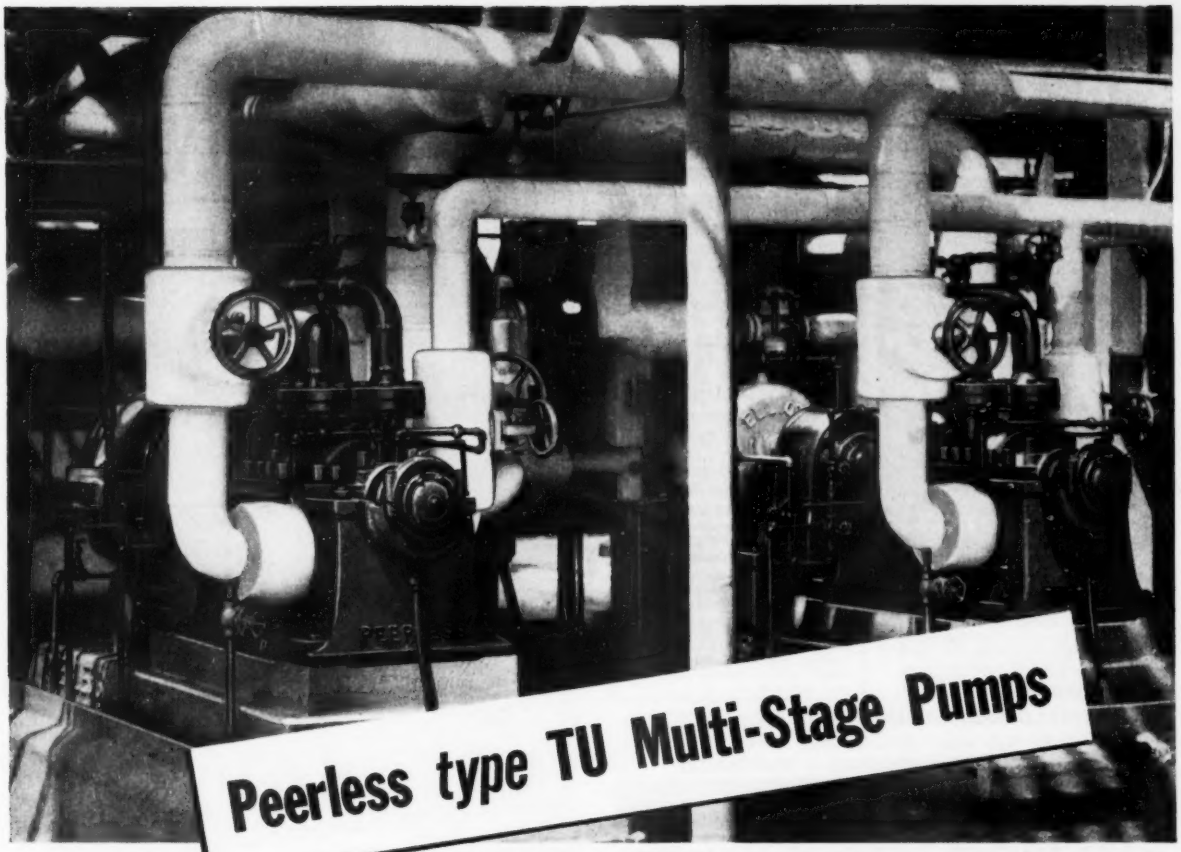
An inexpensive Ranney survey will determine how the Ranney Method can work for you.

If you need water, write us for complete information on how a Ranney Water Collector will solve your problem.

Ranney Method Water Supplies, Inc.

HYDROLOGISTS AND WATER SUPPLY CONTRACTORS

Executive and Engineering Offices
Dept. E5, P.O. Box 277, Columbus 9, Ohio



Peerless type TU Multi-Stage Pumps

PEERLESS PUMPS

GENERAL SPECIFICATIONS

HEADS	Up to 1600 Feet
CAPACITIES	Up to 3000 GPM
TEMPERATURES	Up to 300°F
CASE PRESSURES	Up to 800 Lbs.
HP RANGE	Up to 325 BHP
DRIVES	All Types
CONSTRUCTION	Cast Iron, Bronze, Stainless

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION

Address inquiries to Factories at:
Los Angeles 31, Calif. & Indianapolis, Ind.
Offices: New York; Chicago; Indianapolis; St. Louis; Atlanta; Tulsa; Plainview and Lubbock, Texas; Fresno; Los Angeles; Phoenix; Albuquerque, New Mexico.
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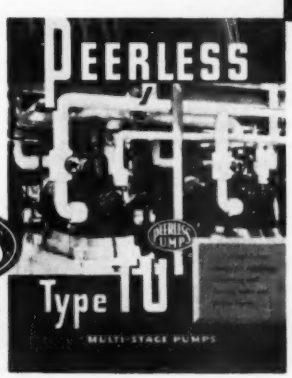
PEERLESS PUMPS fmc

4 COST-SAVING FEATURES OF THE TYPE TU LINE

- *SIMPLICITY IN DESIGN*
- *GOOD HYDRAULIC CHARACTERISTICS*
- *DURABLE, RUGGED CONSTRUCTION*
- *ON-THE-JOB DEPENDABILITY*



2, 3, 4 AND 5-STAGE PUMPS FOR SUPPLYING CIRCULATING AND BOOSTING WATER AND PROCESS LIQUIDS AGAINST MEDIUM AND HIGH HEADS. Put these dependable pumps to work for you. They'll deliver high maintained efficiencies over an extended service life. Their split-case design makes them easy to service and maintain. Their precision construction guarantees year after year durability. In all sizes 4" and under, cross over between stages is built integral with upper pump case. Over-size shafts, wear rings, shaft sleeves, heavy duty ball bearings, modern case and impeller design are outstanding features. Choose from many types and sizes for all head and capacity requirements.

PROFUSELY ILLUSTRATED BULLETIN. A new 4-color bulletin describes the Peerless Type TU pumps. It's complete with pump cross-section, dimensional drawings and load-capacity data. Use coupon below.

MAIL COUPON FOR NEW BULLETIN

PEERLESS PUMP DIVISION
Food Machinery and Chemical Corporation
301 West Avenue 26, Los Angeles 31, California

Please send a copy of TU Pump Bulletin No. B-1400 to:

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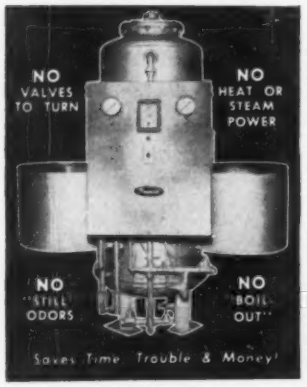
HIGH PURITY WATER

For Boiler Feed, Process & Other Needs



THE LOW COST, NO MUSS, NO FUSS WAY!

Employing the most effective deionizing technique known (intimately mixed cation and anion exchangers in a single tank), raw water passes through a Penfield Automatic Mono-Column Demineralizer only once — *yet comes out with resistances reported as high as 20,000,000 ohms.* Better mineral-free purity than is practical by distillation is supplied for *only pennies per each 1,000 gallons.* And everything is accomplished completely automatically—*without muss or fuss.*

The new Penfield Mono-Column Demineralizer pictured above performs all its operating functions automatically — even accomplishes complete regeneration, including automatically recutting in effluent, with one turn of a switch. Write for full information on units of any desired capacity from 10 to 10,000 gph.

No "Extras"! No "On-The-Job" Assembly Problems!

Penfield Demineralizers are shipped ready-to-operate. Standard equipment includes MONEL METAL regeneration tanks and all necessary gauges, flow meter, conductivity meter, etc. Simply connect the completely "packaged" unit to service lines and start operation.

PENFIELD MANUFACTURING CO., INC.

19 High School Ave., Meriden, Conn.

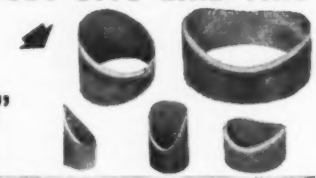
FILTERS · SOFTENERS · DEGASIFIERS · DEMINERALIZERS

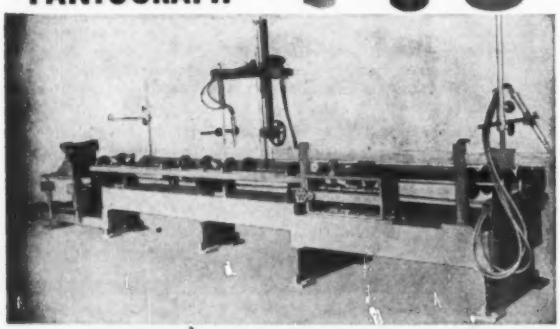
Penfield "Planned Purity" PAYS!

MAKE BEVELED CUT-OFFS LIKE THIS

WITH THE

VERNON "PIPE CUTTING" PANTOGRAPH





This portable, semi-automatic guided torch machine produces saddle and insert type tee intersections, straight or beveled cut-offs, miters and lateral intersections for most pipe sizes from 2" to 24". No layout or templates required and all cuts are extremely accurate and require no cleaning or hand-fitting. No limit to length of pipe that can be handled. ¶ Proved in the field and backed by 20 years of experience and engineering development.

Write for literature and *actual sample of cut pipe*

VERNON TOOL CO., LTD.

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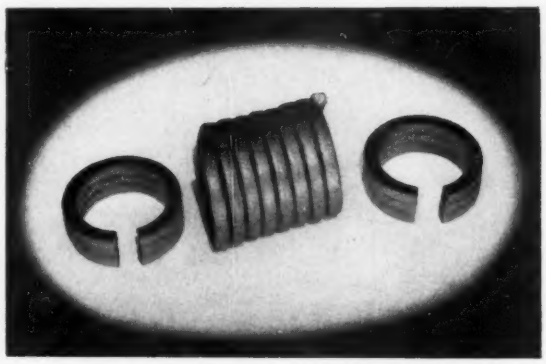
CENTRIFUGAL PUMPS · DESANDERS
VIBRATING SCREENS
PIPE CUTTING PANTOGRAPHS
STEEL VALVES · STUFFING BOXES

NEW PUMP PACKING RESISTS SOLVENTS



SEA-RO SAV-ON

New, pre-tested specially formulated binder makes SEA-RO SAV-ON the ideal packing for centrifugal, rotary and reciprocal pumps handling aliphatic and aromatic hydrocarbons such as petroleum ether, solvent naptha, gasoline, aviation gasoline, benzine, toluol, and other solvents. It will not swell, soften or disintegrate. It forms a smooth working perfect seal, resulting in less adjustments and longer life.

Manufactured from the purest asbestos fibres, soft shredded metals, graphite and lubricants . . . plus a specially compounded binder to resist solvents. Operating efficiency up to 550°F. and 1000 p.s.i. Saving on maintenance alone recommend SAV-ON style #701 or #705 for your tough solvent pumping jobs.

Engineering Data and Catalogue available on request.

Industrial sales territories open for qualified agents.

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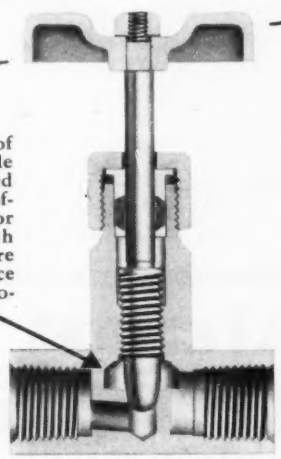
SEA-RO — NEK-SEAL PACKING — PUMP PLUNGER RINGS

MAXIMUM WORKING PRESSURE
10,000 PSI
for water, oil or gas

- Body and stem guide extra heavy bar stock fused into one piece.
- Valve stem 416 stainless steel.
- Packing special one-piece "Marpak" moulded ring.
- Bodies marked in accordance with MSS regulations.



ONE PIECE

The stem guides of conventional needle valves are screwed into bodies—this often causes leakage or blow-outs. Marsh Needle Valves are fused into one-piece by exclusive "Conoweld" process.

Introducing-

The Ultimate in Needle Valves

Here is one of the crowning achievements of Marsh research, design, and manufacturing skill. It is the first needle throttling and shutoff valve to combine *all* of the qualities called for today in this highly critical and ever broadening field.

It is a valve that has strength and safety to spare . . . rated for pressures up to 10,000 psi—equally efficient in the lower ranges. A product of Marsh instrument-making and valve manufacturing experience, it combines instrument-like precision with the ruggedness that distinguishes all Marsh valve specialties.

The illustrations tell the story of new thinking; new standards. Body and stem-guide are machined from extra-heavy carbon steel bar stock. Still greater strength and rigidity are achieved by fusing the stem-guide into the body. The complete fusion of guide and body is accomplished by the exclusive Marsh "Conoweld" process.

There are two big advantages to this one-piece construction: (1) It eliminates the danger of unscrewing the valve from the body when opening—a frequent cause of leakage, even dangerous blow-outs (2) It permits perfect line-up of threads and seat. As a result, Marsh valves are easier to operate even at high pressures.

The precision-machined stem is 416 stainless steel. Stem threads are fine pitch for extra strength and fine, controlled regulation. Notable advancements are special "Marpak" one-piece, non-binding longer-lasting packing; deep thread chambers, keeping inlet and outlet piping away from ports and contributing excellent flow characteristics. Entire packing nut and packing gland are electro-zinc plated, preventing corrosion and giving the valve a handsome, plated exterior. The rugged malleable handle is finished in heavy baked enamel.

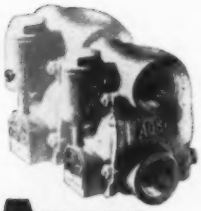
The new needle valve line includes globe and angle patterns with double female connections in sizes ⅛", ¼", ⅜", ½", ¾" and 1". Also globe and angle valves with male inlet and female outlet in sizes ¼" and ½". *Complete stock carried at our Skokie, Illinois factory and also at our branch plant in Houston, Texas.*

Write today for catalog giving complete details.

MARSH INSTRUMENT CO. *Sales affiliate of Jas. P. Marsh Corporation*
Dept. F, Skokie, Ill.
Houston Branch Plant: 1121 Rothwell St., Sect. 15, Houston, Texas

MARSH

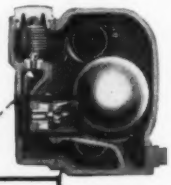
"THE STANDARD OF ACCURACY"

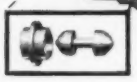


ADSCO

WHEN the valve and valve seat of an ADSCO Dual Steam Trap become worn, neither these parts nor the trap itself need to be replaced. Merely reverse the valve and seat by a simple operation and you double the life of the trap...

DUAL TRAPS LEAD A DOUBLE LIFE





F & T Type

...And here's another great feature of ADSCO Traps. All working parts are mounted on the cover. Pipe connections do not have to be broken for inspection or service... ADSCO Dual Steam Traps are extremely compact with large capacity. Dual inlet and outlet connections reduce installation costs. In the type shown here, an internal thermostatic element provides an automatic air bypass... For complete information, call an ADSCO representative or write the factory.

AMERICAN DISTRICT STEAM COMPANY, INC.

NORTH TONAWANDA, NEW YORK

Since 1877

TYPE PLF EXHAUST FAN

TYPE PLDX DUCT BOOSTER

TYPE PLBD PRESSURE FAN

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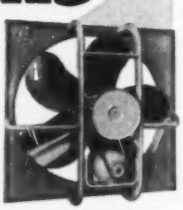
Performance - proven CHELSEA explosion-proof fans meet rigid ventilating and exhaust specifications to the letter. For hazardous locations, specify CHELSEA type fans supplied with Class I, Group D motors, and non-ferrous, non-sparking propellers. Ask CHELSEA for recommendations for your particular processing or industrial need.



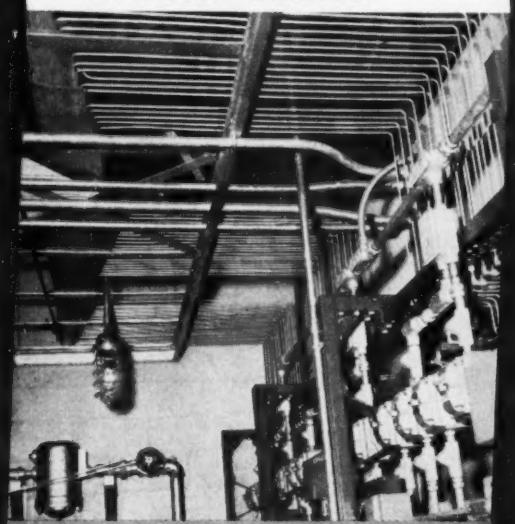
CHELSEA TYPE IND INDUSTRIAL FAN for general ventilating and comfort cooling in factories, foundries, plants, mills, laboratories, etc. Flexible and efficient, it is capable of moving large volumes of air.

Write for Catalog No. 400 address Dept. S-5

CHELSEA FAN & BLOWER CO., Inc.

PLAINFIELD, NEW JERSEY

Here's how El Dorado Refining Company uses ALCOA UTILITUBE



AIR LINES serving instruments at El Dorado Refinery, El Dorado, Kansas. Exposed to typical refinery vapors, 9,000 feet of corrosion-resistant Alcoa Utilitube* were required for this installation. Air, dried by Alcoa *Activated** Alumina, operates at 110° F and 110 psig.

ALCOA UTILITUBE is the lowest cost corrosion-resistant tube you can buy—up to 40 per cent less than other corrosion-resistant metals!

ALCOA UTILITUBE is versatile. Use it for air for pneumatic and hydraulic control circuits and brake lines—gasoline and fuel oil for internal combustion engines—lubricating oils for engines and machines—fluids for hydraulic systems.

ALCOA UTILITUBE stands up well under vibration and also forms and flares easily.

ALCOA UTILITUBE and fittings are available from your aluminum distributor. Look for his name in your classified phone directory. Write for the new booklet: "Alcoa Utilitube."

ALUMINUM COMPANY OF AMERICA
1004-E Alcoa Building, Pittsburgh 19, Pa.

*Registered Trademark, Aluminum Co. of America

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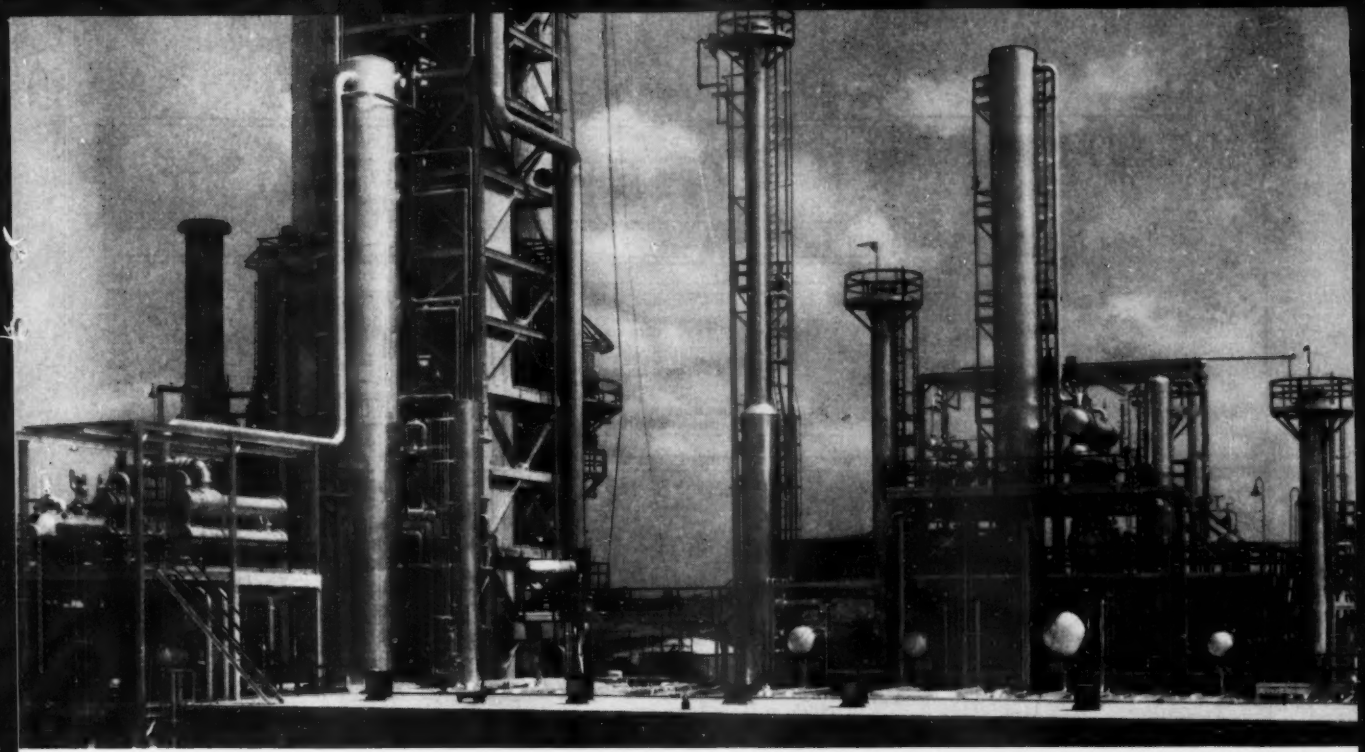
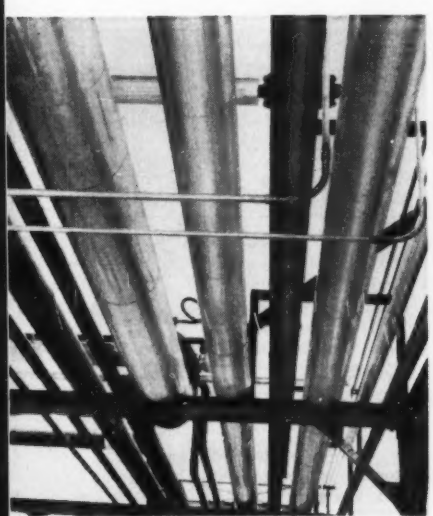


Refineries cut maintenance on insulated lines by switch to new low-cost aluminum jacketing

"It cut jacketing application costs, and we expect it to last for years," report engineers at refineries everywhere after testing Childers Aluminum Jacketing on their insulated lines. This new Oklahoma refinery used Childers 100% — on towers and vessels (in heavy weight) as well as on lines. It is flexible and easy to put on, and this 35 alloy aluminum is tough and weather-resistant, even in corrosive industrial atmospheres. This is the first and only jacketing especially engineered for process plants and power installations.

At least 567 processing plants have installed and tested this new Childers Aluminum Weatherproof Jacketing during the last three years. You can examine its advantages for your plant by writing for a free sample. Address Childers Manufacturing Co., Dept. PO-4, 3620 W. 11th St., Houston 8, Texas.



These lines are insured for years against wear and weather. They'll never need painting because Childers Jacketing gives them all the advantages of appearance and long life that come only with weather-resistant aluminum. Yet this specially engineered jacketing costs far less than would heavy aluminum sheets.

As shown here, Childers Jacketing can be attached with no more tools than a pliers and a wooden wedge. No expensive shop work or pre-forming are necessary. Several methods of attaching are available, but aluminum bands shown here are probably best and cheapest. Because this jacketing is so easy to handle and so simple to attach, it cuts installation costs way down.

This is how the flexible, easy-to-handle Childers Jacketing arrives at the job site. It is in convenient rolls 4 feet wide and 100 feet long—just right for one man to handle—and is available either with or without a moisture barrier attached on the back of the .006" aluminum "skin". It can be cut to proper lengths using any flat table and a straight-edge.

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Since 1909

● The valve with the renewable feature restores old pumps to original efficiency. Constant contact is maintained over the full bearing surface no matter in what position the valve rotates because of the exclusive HILL design. Efficient, durable, economical, accurate.

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With FORMULA NO. 640, a clear liquid which penetrates 1" plus in concrete, brick, stucco, plaster, etc. Seals out water, dirt. Holds 20' head. Use outside and in. Preserves all absorbent materials. Sold 14 years. Quick, economical, sure. $3 in 55's. Free sample. See Sweet's.
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- Bauxite
- Catalysts
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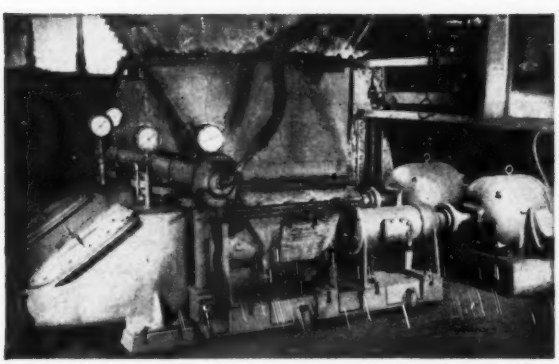
- Cement raw Materials
- Chalk
- Clays (dried)
- Coal (pulverized)
- Coke Dust
- Dolomite (pulverized)
- Feldspar
- Flue Dust
- Fly Ash
- Fuller's Earth
- Gypsum (calcined)
- Gypsum (raw)
- Lime
- Limestone (pulverized)
- Magnesite
- Manganese dioxide
- Ores (pulverized)
- Phosphate rock (pulverized)
- Rock dust
- Soda ash
- Starch



Quick, dust-free handling of pulverized coal, using Fuller-Kinyon System.

Check and

PASS ON

Make this a memorandum — and Pass On to others — if your processes require mass handling of dry, pulverized materials.

Check the materials which you handle and *Pass On* this information to the Fuller Company.

With twenty-six years of experience in this specific field, the Fuller Company can help engineer your handling methods into less costly, more efficient, more dependable operation.

THE FULLER-KINYON SYSTEM FOR DRY PULVERIZED MATERIALS CONVEYING HAS SEVERAL DISTINCT BENEFITS:

1. Mechanical movement limited to few parts.
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3. No explosion or occupational hazards.
4. Pipelines carry material vertically, horizontally, around corners — between multiple operations.
5. Fuller-Kinyon Pumps maintain full capacity over long travel distances, at low cost.
6. Portable units perform several operations.

Pass on the word to Fuller for specialized engineering assistance on any problem involving mass handling of dry, pulverized materials. Fuller's twenty-six years of such experience is yours to command. Send along a memorandum to Fuller now.

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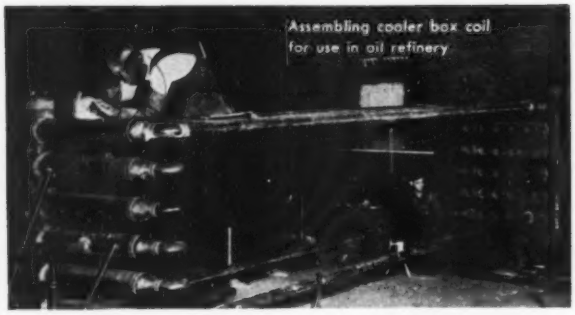

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No special piping design presents too great a challenge for Western Piping Supply's many specialists. Engineers, pipe benders, welders, or the men who align, heat treat, or test—all have the skill and good judgment bred of long experience. These men stand ready to handle all your pre-fabricated piping requirements, whether of special or conventional design.

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ASSISTANT TO Chief Engineer in municipal steam power plant of 22,500 KW. Should have knowledge of operation and maintenance of steam turbines, motors, pumps, boilers, combustion control and feedwater treatment. Need initiative and supervisory ability. Advancement opportunity excellent. Location—Southwest. Starting Salary —$4000.00 to $4200.00. P-7232, Power.

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CHEMICAL ENGINEER, or chemist for industrial water treatment. Large chemical company with offices on the east coast. We need a technical man with laboratory and field experience in the treatment of boiler water, cooling water, etc. Submit resume and salary requirements. P-7322, Power.

WANTED: MECHANICAL Design Engineer with experience in Industrial, Chemical or Steam-Electric Power Plants. Must be qualified for design, specifications, cost estimates, supervision and client contacts. This Position is with a growing organization of Design Engineers located in Philadelphia and offers an opportunity for advancement and permanency. Write giving complete personal history, experience and earnings record, and references. P-7484, Power.

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WANTED A Salesman for nationally known Pipe Fabricating and Erecting Company. College Graduate in Engineering—plus knowledge of the piping industry required. Person desired: Approximately 35 years of age and willing to do extensive traveling. Good Salary and Expenses. SW-7548, Power.

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SALARIED PERSONNEL. $3,000-$25,000. This confidential service established 1927 is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. G, 241 Orange St., New Haven, Conn.

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LICENSED MARINE Chief Engineer, age 28. Technical school grad. in mechanical and electrical engineering. 10 years experience. Desires position. PW-7247, Power.

EXPERIENCED AND reliable mechanical maintenance engineer. Responsibilities and advancement opportunities desired. Power utilities preferred. Steam licensed. PW-6563, Power.

(Continued on Page 300)

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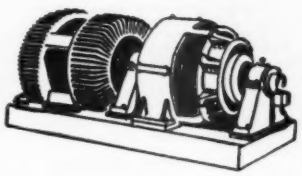

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CITY ..... ZONE ..... STATE .....

5/53

Additional Position Vacant Advertising on page 300

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ASSOCIATE ENGINEERS
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MECHANICAL
ELECTRICAL
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WANTED BY RAPIDLY GROWING ELECTRIC AND GAS COMPANY ON EAST COAST

Experienced Engineers required in Engineering Department for expansion program covering Steam Power Plants, Electric Generation, Transmission and Substations and Gas Production and Transmission. Jobs offer permanent employment with ample advancement opportunities for men with ability and initiative.

Pleasant congenial suburban community in close proximity to a Metropolitan Area.

Write giving full particulars of education, experience, and salary to:

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When required personal interviews will be arranged for evenings or Saturdays.

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Graduate Mechanical, Chemical or Civil Engineer for complete charge under Chief Engineer of 3500 KVA diesel generating plant; all shops; foundry; mobile equipment including loading, marine, railway; construction; maintenance of all types equipment at property. Must have natural mechanical ability, be good organizer with excellent practical and supervisory references. Also construction experience.

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Minimum high school graduate. Must have served apprenticeship in large modern machine shop; should have served as foreman minimum 5 years; should be able to demonstrate methods and instruct men in handling and operating tools; must have organizing ability. Knowledge of construction methods desirable but responsibility for construction and power plant operation depends on man's qualifications.

Age limits 33-45. Three year contract with 3 months' paid vacation at completion contract and two 1-week local leaves after first year. Furnished house and partial utilities supplied free. Free transportation self and family. Free hospital and medical. Free schooling to 14 years. Non-contributory pension plan. Report single status six months. Require complete record and references. Photograph optional. Location—Mediterranean. Large Copper Mine. Salary open.

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WANTED

Plant Engineer with 10 to 15 years experience in food industry for manufacturing plant in New Jersey. Should be familiar with steam plant, air conditioning and automatic packaging machinery. Responsibilities will include all plant maintenance. M.E. degree preferred. Send complete resumé and salary requirements to

P-7378, POWER
330 W. 42 St., New York 36, N. Y.

POSITIONS WANTED
(Continued from preceding page)

ENGINEER—B.S. in E.E. 15 years Mechanical & Electrical experience, desires position as Plant Maintenance Engineer. PW-7676, Power.

MECHANICAL ENGINEER, with wide experience in Industrial methods, plant layouts, construction and sales promotion; also planning and supervising land development. Has initiative, energy, good health and cordial personality. Working as Sales Engr. & Contractor for Power boilers, etc. Wants new connection where ingenuity and ability can be used to advantage. PW-7526, Power.

POWER AND Maintenance Supt. M.E., 35. Must relocate due to family health. Thoroughly experienced and seasoned in construction, plant start-up and steam-power generation to 25,000 KW. Particularly adaptable to plant betterment or operation in utility or industrial plant. Excellent references including present chemical plant principal for whom plant was constructed, initially started, and personnel trained. Would consider foreign assignment in desirable locale. PW-7386, Power.

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SALESMAN WITH twenty-five years sales and service experience selling industrial and power plants in New England seeks correspondence with concerns desiring representation. Am willing to relocate. Best of references furnished. Write Position, Box 101, Eastford, Conn.

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To assist in the supervision of daily operation, the planning of new steam turbo installations, revision of existing units, and the layout of power lines and substations. Must have E.E. or M.E. degree plus minimum 5 years' steam power plant experience, handling operational and maintenance phases.

Write giving full particulars regarding personal history and work experience. Please include telephone number. Do not include original or valuable documents.

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Send resume of education and experience with photo, if possible. State compensation requirements. All replies confidential.

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E. F. DREW & CO., INC.
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FOR SALE

Two engine-generator sets in good running condition. May be seen in operation with due notice. Selling "as is and where is" due to changeover to purchased current.

No. 1 Engine-Generator Set

No. 113467 Allis Chalmers generator, 480 volts, 98 amperes, 3 phaes, 60 cycle, 277 RPM, 72 KW, direct connected to an Ames Uniflow engine, size 14 x 15, 130 PSIG and 5 PSIG back pressure. V-Belt driven Allis Chalmers exciter, complete with panel and new Allis-Chalmers V-11 Rocking Arm type voltage regulator.

No. 2 Engine-Generator Set

No. 307652 Western Electric generator, 480 volts, 187 amperes, 3 phase, 60 cycle, 257 RPM, 120 KW, direct connected to an Ames Uniflow engine, size 15 x 16, 130 PSIG and 5 PSIG back pressure. V-belt driven Western Electric exciter, complete with panel and new Allis-Chalmers V-11 Rocking Arm type voltage regulator.

Write or call

LEON J. BAKER
GEORGE SCHOOL, PA.
TELEPHONE NEWTOWN 3511

WORLD'S LARGEST INVENTORY

Established 1934

D & B Rated

MAY BULLETIN

TRANSFORMERS—WORLD'S LARGEST INVENTORY

All Single Phase Unless Otherwise Noted.

KVA		PV	SV
1—6000	3 ph.	24000	5040/4800
1—3750	3 ph.	22000	600
1—3750	3 ph.	22000	440
1—3000	3 ph.	22000	440
1—3000	3 ph.	22000	480
3—2500		27600	2300
4—1000	3 ph.	13800	600
3—1000	3 ph.	13800	480
3—1000		13800	230/460
1—1000	3 ph.	2200	220 Delta
3— 833		2300	575
2— 833		13800	460
3— 800		22000	2200
4— 750		2200	244/488
8— 667		13200	2300
1— 667		13200	480
3— 667		6600	2300
1— 500	3 ph.	4000 WYE	460 delta
1— 500		4600	460
2— 500		11000	2300
3— 500		11400	40/80
3— 500		13800	460
6— 500		33000	6600/2300
1— 450		11000	230
1— 450		11000	460
3— 450		23000	445
3— 400		2200	244/488
2— 400	3 ph.	2300	230
6— 333		22000	2400
2— 333		11500	115/230
3— 333		2400	240/480
3— 333		2400	120/240

3—1250 KVA, G.E. transformers, 11,000 Pr. V. with 4 taps on 33,000, 2200 Sec. V., 25 cy. 1 ph. (O.K. for 60 cycle). Ser. 2,297,476-7-8.

PARTIAL LIST—2000 UNITS IN STOCK FROM ONE TO 333 KVA
ALSO
AIR COOLED AND SWITCH GEAR

AC GENERATORS—ALTERNATORS—CONDENSERS

Quan.	KVA	HP	RPM	Cycle
2		2500	720	60
1		1675	600	40
2		1500	900	60
1		1500	1200	60
1		1430	514	60
3		1250	720	60
1		1250	1200	60
2		1000	600	60
1		1000	750	60
1		1000	750	25
1		800	900	60
1		720	900	60
2		650	139	60
1		500	720	60
1		412	225	60
1		400	450	60
3		400	1800	60
1		375	750	25
2		375	1200	60
1		350	720	60
1		300	750	25
1		312	1200	60
1		300	180	60
1		280	1200	60
1		250	900	60

Plus 78 smaller units from 3 KVA to 250 KVA

Cash for Your Surplus

SLIP RING MOTORS

Quan.	HP	Speed	Make
1	1200	237	Cr. Wh.
1	600	1800	G. E.
1	500	1800	G. E.
1	400	514	G. E.
1	400	435	West.
1	300	500	G. E.
1	300	450	G. E.
2	250	600	G. E.
1	250	480	G. E.
2	200	600	G. E.
3	200	450	Burke
3	150	720	G. E.
1	150	450	G. E.
1	125	435	G. E.
6	100	450	G. E.
1	100	900	G. E.

Plus 837 smaller units 1 HP to 75 HP

"There now, Sonny, are you satisfied that the propeller beanie really works?"

SQUIRREL CAGE—60 CYCLE

HP	Speed	Make
500 (3)	514	West.
450	720	G. E.
400 (2)	514	West.
300	600	West.
250 (2)	3600	G. E.
250	1200	Al. Ch.
250 (6)	900	West.
250 (2)	720	Oper.
200 (2)	1800	West. TEFC
200 (3)	1800	Wag., Pel.
200	1800	G. E.
200	600	Al. Ch.
150	900	G. E.
150	400	G. E.
125 (5)	1800	Al. Ch.
100 (2)	1800	West.

P.S. We stock 3500 new and rebuilt 1 HP to 100 HP

MOTOR GENERATOR SETS AC — DC

Quan.	KW	Make	Volts
1	1500	G. E.	300
2	1000	G. E.	600
1	1000	G. E.	250
1	1000	West.	250
1	750	Al. Ch.	275
1	600	G. E.	250
1	500	West.	125
3	500	West.	250
2	500	G. E.	250/275
1	500	G. E.	275
1	400	West.	125/250
1	400	West.	500
1	325	G. E.	500
2	300	West.	275
1	300	West.	550
2	200	West.	600
1	200	West.	250
1	170	G. E.	125
1	150	West.	125/250

Plus 238 sets from 1 KW to 150 KW in stock.

DC—ADJ. SPEED—230 V.

Quan.	HP	Make	Speed
1	3600	Dynam.	800/2000
1	650	G. E.	750/2000
1	300	G. E.	400/ 800
1	250	West.	250/ 675
4	250	West.	540/3000
1	125/190	G. E.	260/ 400
1	150	West.	320/ 680
1	150	Rel.	400/1200
1	100/150	West.	500/ 750
1	100	G. E.	1050/4000
2	100	Rel.	575/1150
2	100	West.	450/1000
1	60	El. Dyn.	525/1050
2	30/71	West.	450/1000
1	50/60	G. E.	220/1000
2	50	Diehl	400/ 800
1	25/50	G. E.	300/1200
1	35	G. E.	250/1000
1	30	West.	500/1000
1	30	West.	700/1750
1	30	Rel. TEFC	400/1200
3	25	G. E.	500/1500

Plus 327 smaller units 1 HP to 25 HP

CONSTANT SPEED—230 V.

HP or KW	Make	Speed
500 KW (2)	West. 125/250 V.	900
400 HP	El. Dyn.	1500
400 HP	G. E.	450
360 KW	G. E. 180 V.	1300
300 KW	West. 125/250 V.	1200
300 KW	G. E. 170 V.	1200
250 KW	Al. Ch.	750
150 KW	West. 125/250 V.	750
150 KW	G. E.	1200
150 HP	West.	1615/1785
125 HP	Star	1200
120 KW (2)	G. E.	1250

Plus 675 smaller units 1 HP to 120 HP also 115 V. & 550 V. DC.

ELECTRIC EQUIPMENT COMPANY

PHONE LD65

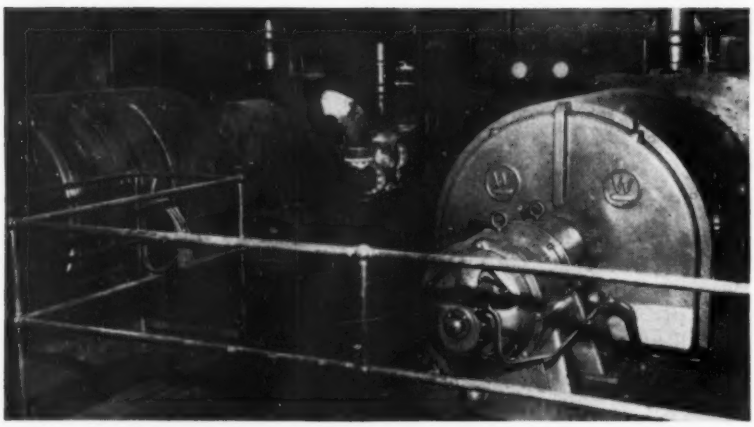
ROCHESTER, N. Y.

New and Rebuilt — 1 H. P. to 2500 H. P.

MOTORS · MG SETS · TRANSFORMERS · CONTROLS · COMPRESSORS

2500 KVA
Modern Design

NON-CONDENSING TURBO-GENERATOR
Like a New Machine



Write now for Inspection Report and Drawings

Above Cut Was Made From Photograph Taken on Foundation of Our 2500-KVA., Westinghouse Non-condensing Turbo-Generator: A Very High Grade Modern (1935) Machine. Complete Unit With Direct Connected Exciter, Switchboard, Etc. DELIVERY, IMMEDIATE.

With Moderate Changes is Suitable for 400#, 700°TT., 50# Back Pressure.

WATER RATE:	KW. Load	1000	1500	2000	2500
	Lbs. KWHr.	27.1	25.85	26.0	26.2

BELOW IS A PARTIAL LIST OF OUR STOCK

TURBO-GENERATORS ALL 3600-RPM.

CONDENSING

No.			
1	500-KW.	A.-C.	150/200 psig. 480-V
2	500-KW.	G.-E.	150/200 psig. 480-V
3	625-KW.	G.-E.	160/200 psig. 480-V
4	750-KW.	A.-C.	150/200 psig. 480-V
5	750-KW.	West.	140/200 psig. 2300-V
6	750-KW.	A.-C.	150/200 psig. 2300-V
7	750-KW.	G.-E.	150/200 psig. 480-V
8	1000-KW.	G.-E.	175/250 psig. 2300-V
9	1000-KW.	A.-C.	125/200 psig. 2300-V
10	1500-KW.	A.-C.	150/200 psig. 2300-V
11	1200-KW.	G.-E.	175/200 psig. 2300-V
12	2000-KW.	G.-E.	150/200 psig. 2300-V
13	2500-KW.	G.-E.	150/250 psig. 2300-V
14	3000-KW.	G.-E.	150/250 psig. 480-V
15	4000-KW.	West., A. Ext.	275/400# 600-V
16	5000-KW.	G.-E.	150/200# 2300-V
17	5000-KW.	West.	250/400# 480-V.

NON-CONDENSING

No.				
1	500-KW.	A.-C.	125#:10/15 BP.	480-V
2	500-KW.	G.-E.	175#10/15 BP.	480-V
3	500-KW.	West.	250/400:125# BP.	2300-V
4	750-KW.	G.-E.	125#:10# BP.	480-V
5	1000-KW.	G.-E.	125#:15 BP.	480-V
6	1250-KW.	G.-E.	200/250 psig. 20# BP.	480-V
7	2000-KW.	West.	250/350#:35# BP.	2300-V
8	2500-KW.	G.-E.	150/175#:15# BP.	2300-V
9	3000-KW	A.-C.	425#750F:60# BP.	13200-V
10	4000-KW	G.-E.	425#, 75° FSH. 60# BP.	13200-V

BOILERS, ETC.

B&W., 600#, 100,000# Steam per hr.
2—Springfield 511-HP., 250# 1935
1—Springfield 900-HP., 400# 1932
2—B&W 604-HP., Cond. A-1

Please Send Us Your Specifications for Diesel Engines, Boilers, Pumps, Etc.
Our New Stock List Is Just Off the Press. Send for It.

CORRESPONDENCE INVITED.

TELEPHONE WRITE OR WIRE

CHARLES WEAVER
4145 PENOBSCOT BUILDING
DETROIT 26, MICHIGAN

ANYTHING FOR YOUR POWER PLANT

Telephones:
WO. 1-1340
" 1-1341
" 1-6038

ELECTRIC MOTORS AND GENERATORS

WAGNER CERTIFIED REBUILT WAGNER

BACKED BY 47 YEARS OF QUALITY AND SERVICE

ANOTHER CUSTOMER TELLS WHY—

"Check with Wagner First"

WAGNER *"Certified Rebuilt"* MEANS:

1. Thorough Rebuilding
2. Careful Testing
3. Honest Guarantee
4. Save Money Safely
5. Quick Shipment
6. Complete Quotations

A. C. GENERATORS — 60 CYCLE

KVA	Mfr.	Type	Volts	Speed
1000	Whse. syn. cond.		4000/2300	900
625	Gen. Elec.	ATB	2300	450
625	G.E. 25 cycle	ATB	2300	750
600	Gen. Elec.	ATB	480	900
625	El. Machy.	Late	240/480	1200
485	Allis. Ch.	1 brg.	480	400
375	G.E.	ATI	240/480	1200
350	El. Machy.	1 phase	480	1200
312	Gen. Elec.	ATB	240/480	600
275	G.E. 25 cycle	ATI	480	750
225	El. Machy		480	720
225	Gen. Elec.	ATI	240/480	900
150	Whse.		2300/480	600
125	Gen. Elec. (2)	ATB	240/480	900
112	Gen. Elec.	ATB	240/480	900
90	Gen. Elec.	ATI	240/480	1200
75	Gen. Elec.	ATI	240/480	1200
75	El. Machy.		2300	900
56	G.E.	ATB	240/480	1200

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
300	Al. Ch.	MECW	125/250	1200
250	Allis Ch. b.b.	EW	350	1200
150	Whse.	SK191	125/250	900
125	Gen. Elec.	RC	250	1800
125	Gen. Elec.	RC38	250	675
105	Century b.b.	1500 amp.	70	1200
100	Allis Ch.	E	125	1200
75	Cr. Wh. b.b.	CCD	250	1500
75	Whse.	SK	250	1200
60	G.E.	RC	250	1450
60	Whse.	SK160	250	1000
50	Allis Ch.	EW	125/250	1200
50	Gen. Elec.	RC	125	1200
40	Gen. Elec.	RC	600	1750
40	Gen. Elec.	RC	250	1750
25	Whse.	SK93	125	1750
20	Gen. Elec.	RC	125	1150
15	Star b.b. (10)	SQ	250	1500

D.C. MOTORS

HP	Mfr.	Type	Volts	Speed
300	Gen. Elec.	MPC	250	500
300	Allis Ch. b.b.	EW	350	1000
200	Al. Ch. b.b.	E	250	600/1000
150	Gen. Elec.	RC36	230	1700
150	Gen.Elec.	RC39	230	550
100	Whse.	SK	230	400/1200
75	Whse.	SK170	230	635
75	G.E. (2)	CD 115	230	1150
75	Whse.	SK163	230	850
60/75	Gen. Elec.	C	230	500/1200
50	Gen. Elec.	CD123	230	550/1200
50	Gen. Elec.	RC33	115	1100
40	Gen. Elec.	RC32	230	1100
35	G.E.	RF-14	230	250/1000
30	Imperial b.b.	D69	230	400/1600
30	Gen. Elec.	LC	230	500/1500
30	Whse.	SK110L	230	1150
30	Star b.b. (3)	SB	230	1750
25	Whse.	SK150	230	300/1200
25	Gen. Elec.	CD85	230	1750
25	Gen. Elec.	CD105	230	575/1725
20	Century bb.	DN336	230	3500
20	G.E. series	CO-1826	230	875
20	Whse. b.b. (2)	SK97	550	900

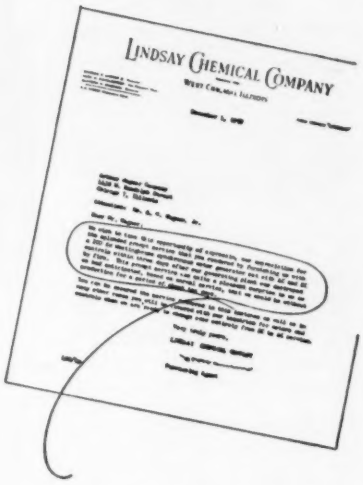
A. C. MOTORS

H.P.	Mfr.	Type	Volts	Speed
800	G.E.	Slipring	2300	400
750	Whse.	Synch.	2200/4000	900
600	E.M.	Synch.	2200	514
650	E.M.	Synch.	480	1200
500	G.E.	Sq. Cage	6600/4000	1800
500	G.E.	Synch.	440	900
500	G.E.	Slipring	2200/440	450
500	Al. Ch.	Synch.	440	400
450	Whse.	Synch.	2300	900
400	Whse.	Sq. Cage	2200	514
400	G.E.	Sq Cage	2200	1800
400	G.E.	Synch.	440	450
400	Allis Ch.	Sq. Cage	2200	1200
350	G.E.	Slipring	2200/440	300
350	Whse.	Slipring	2300	450
300	G.E.	Slipring	440	600
300	Allis Ch.	Sq. Cage	2200	1800
300	Al. Ch.	Sq. Cage	2200/440	720
300	El. Mach.	Synch.	2200/440	360
300	Whse.	Synch.	2200/440	600
300	Al. Ch.	Slipring	2300	514
300	G.E.	Slipring	440	360
250	G.E.	Slipring	2300	450
250	G.E.	Slipring	440	600
250	Whse. (2)	Sq. Cage	2200/440	1200
250	L.A. (2)	Sq. Cage	2200	1800
225	G.E.	Synch.	220/440	900
200	Whse. XP	Sq. Cage	2200/440	1200
200	G.E.	Slipring	220/440	514
200	G.E.	Sq. Cage	220/440	600
200	Cr. Wh.	Sq. Cage	220/440	3600
200	Whse.	Sq. Cage	2200/440	900
200	G.E.	Slip Rings	220/440	600
200	E.M.	Synch.	220/440	1200
200	G.E.	Sq. Cage	220/440	1200
200	Al. Ch.	Synch.	440	360
200	G.E.	Slipring	220/440	360
200	G.E.	Sq. Cage	220/440	1800
200	Rel. b.b.	Sq. Cage	220/440	1200
200	E.M.	Synch.	220/440	514
160	Whse.	Synch.	220/440	600
150	G.E.	Slipring	220/440	600
150	G.E. TEFC	Sq.Cage	2200	3600
150	Al. Ch.	Sq.Cage	2200	3600
150	Rel. b.b.	Sq. Cage	220/440	1200
150	Allis Ch.	Slipring	2200/440	720
150	G.E. (2)	Sq. Cage	2200/440	720
150	G.E.	Slipring	220/440	450

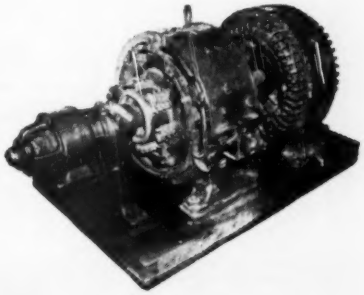
M-G SETS

KW	Mfr.	Input V		Output V	
500	Whse.*	2300	AC	250	DC
360	G.E.*	2300/4000	AC	250	DC
300	Allis Ch.	440	AC	125/250	DC
300	Whse.*	2300	AC	600	DC
250	Allis. Ch.	440	AC	350	DC
200	**Whse.* (2)**	**220/440**	**AC**	**55**	**DC**
200	G.E.*	220/440	AC	250	DC
200	Gen. Elec.*	220/440	AC	125	DC
150	Whse.*	220/440	AC	125/250	DC
105	Century b.b.	220/440	AC	70	DC
100	Whse.*	2300/4000	AC	275	DC
100	Al. Ch.	220/440	AC	125	DC
100	Delco b.b.	220/440	AC	125/250	DC
100	Allis Ch.*	220/440	AC	50	DC
75	C.W. b.b.	220/440	AC	250	DC
75	Whse.	440	AC	250	DC
60	Gen. Elec.*	220/440	AC	60	DC
50	Gen. Elec.	220/440	AC	125	DC
50	Allis Ch.	220/440	AC	125/250	DC
45	Gen. Elec.*	220/440	AC	60	DC
40	Gen. Elec.	220/440	AC	250	DC
30	Otis (5)	220/440	AC	250	DC
25	Whse.	220/440	AC	125	DC
20	N.W.	220/440	AC	250	DC
20	Whse.	220/440	AC	600	DC
21	Whse.	220/440	AC	35	DC
17	Gen. Elec.	220/440	AC	125	DC

THESE ARE PARTIAL LISTINGS . . . 10,000 OTHER UNITS IN STOCK.


LINDSAY CHEMICAL COMPANY

"...expressing our appreciation for **prompt service** by furnishing us an M-G Set....**within three days** after our generating plant was destroyed by fire..."



The 200 KW Westinghouse synchronous motor generator set referred to in above letter from LINDSAY CHEMICAL CO.

Gearhead Motors — Controls — Transformers

Arthur Wagner Co.

1435 W. RANDOLPH ST. MOnroe 6-7409 CHICAGO 7, ILLINOIS

MAY 1953

CHICAGO Electric Digest

PUBLISHED BY CHICAGO ELECTRIC CO. • THE HOME OF GUARANTEED REBUILT POWER EQUIPMENT

EQUIPMENT REBUILDING AT ITS FINEST!

SQUIRREL CAGE

MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*220 volts or higher)

HP	Make	Type	Speed
1750	*G. E	K	3600
1000	*G. E	K6347S	1800
750	*A. C	TEFC	1800
750	*G. E.	KT	720
700	G. E.	FT	3600
500	*G. E.	PBG	3600
500	*A. C.	6316SW	1800
450	*G. E.	KF567S	1200
400	*Westgh.	CS	1800
400	*G. E.	KTP562	1800
400	A. C.	ANW	900
400	*G. E.	IK	514
350	*Cr-Wh BBDP	SC	3600
300	*Westgh.	CS	3600
250	*L. Allis	OGS	1800
250	*L. Allis	OGX148S	720
250	G. E.	IK	600
200	*G. E.	FT549Y	3600
200	*G. E.	IK13B	1800
200	A. C	ARWWT	600
200	G. E.	IK-17	600
150	*A. C.	AN	1800
150	G. E.	IE-K	1800
150	*G. E.	IK	600
150	A. C.	AR	325
125	Westgh	CS504S	3600
125	*A. C.	AR226	1800
125	G. E.	IK	1200
100	*G. E	FT542Z	1800
100	Westgh.	CS	1800
100	A. C.	AW	1200
100	G. E.	IK13A	1200
100	U. S.	CFU(Vert)	1200
100	*Westgh	CS(Vert)	1200
100	A. C	AN	900
100	G. E.	IK15A	514
75	Westgh.	CS445S	3600
75	A. C.	AN	1800
75	Westgh	CS645C	1800
75	G. E.	KT346	1200
75	G. E.	IK	1200
75	Westgh.	CS	900
75	*A. C	AR(Vert)	900
75	A. C.	AN	720
75	G. E.	IK	600
75	*Triumph	TR16	514
75	G. E.	IK	514
60	*Westgh.	CS504S	1800
60	A. C.	APZ445S	1800
60	A. C	APZ504U	1200
60	G. E.	KT343	1200
60	A. C	AR823	900
60	A. C.	AR826F	514

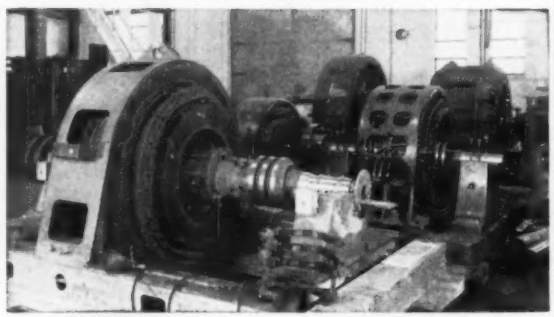
Hundreds of smaller motors!

AC SYNCHRONOUS

MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 volts or higher)

HP	Make	Type	P.F.	Spd
2500	*A. C.		1.0	514
1420	*Westgh.		.7	900
720	*G. E.(25 cy)	ATI	1.0	750
700	*G. E.	TS975Z	1.0	1200
600	*G. E.	TS7640	1.0	900
600	*G. E.	ATI	1.0	240
400	Westgh.	HG	1.0	900
300	G. E.	ATI	.8	900
300	*G. E.	ATI	1.0	720
300	Ideal	SNS	1.0	257
190	Ele-Meh	2S	1.0	720
175	*Westgh.	HR	1.0	360
150	*Westgh.	HR	.8	900
125	G. E.	ATI	1.0	900
125	*Ele-Meh		1.0	900
125	Cr-Wh.	103S	1.0	900
125	*G. E.	TS	1.0	277
115	Ele-Meh	EM	1.0	240
100	Cr-Wh.	103S	.8	900
100	*G. E.	ATB	.8	900
100	Westgh		1.0	900
100	Ideal	SNS	1.0	900
100	G. E.	TS6184	1.0	450
40	G. E.	ATB	.8	1200
20	Fynn-W	15VRN		1200
15	Ideal			1800
15	Century	ARC365	1.0	1200
7½	Ideal			1800



SLIP RING

MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 volts or higher)

2000	*G. E.	MT-12	600
1500	*G. E.	MT30	240
1250	*Westgh	CW	600
1000	*Westgh	CS	250
700	*A. C.		720
500	*G. E.	IM	3600
500	*G. E.	MTP	1800
500	G E	IM	720
500	Westgh.	CW	350
400	A. C	3-brg	450
400	*G. E.	MT412	450
300	*G. E.	IM15A	1800
300	*G. E.	MT410	450
250	Westgh.	HF15H	600
200	G. E	IM	1800
200	G. E.	IM15	1200
200	Westgh.	CW	600
150	Westgh.	CW772C	1200
150	*G. E.	IM16	600
125	*G. E.	MT549	1800
125	G. E.	IM15A	600
100	A. C.	ANY	900
100	G. E.	IM15A	450
75	Nwstrn.	HW50	1800
75	G. E.	MT347	1200
75	G. E.	MT356	900
75	G. E.	IM	900
75	G. E.	IM	720
75	G. E.	IM14	600
60	Westgh.	CW762C	900
50	G. E	IM11A	1800
50	*A. C.	ARY	1800
50	Westgh.	CW636A	1200
50	G. E	MT346	720
50	G. E.	IM14	450
40	*G. E.	MT532	1200
40	G. E.	MT336	1200
40	Westgh.	CW644	900
40	G. E	M504U	900
35	Fbks-M.	UAB(Vert)	1800
35	G. E.	IM	1200

TRANSFORMERS

KVA	Make	Phase	Pri.	Sec.
1000	Westgh.	3	4800	480
850	Westgh.	3	4160	455
667	G. E.	1	33000	480
333	A. C.	1	14400	240/480
300	G. E.	3	13800	240/480
300	G. E.	3	2400	240/480
200	Wagner	1	2400	575
167	A. C.	1	2400	120/240
100	Pittsbgh.	1	2400	575
100	A. C.	1	2400	120/240

D. C. MOTORS

Mill Type—Pedestal Bearing Reversing

HP	Make	Volts	Speed
3000	Westgh(Tandem)	525	600
1750	Westgh	600	550
1500	Westgh	525	600
1200	Westgh	525	600
1000	Westgh	450	600

Mill Type—Non-reversing

HP	Make	Type	Speed
1500	Westgh (600v)		200/400
700	Westgh (600v)	MCF	150/525

230 Volts—Constant Speed

175	G. E.	ELC	750
125	G. E.	Marine	1200
100	G. E.	RC34	2500
100	G. E.	RC19	575
75	G. E.	MDS106	485
60	G. E.	CD-115	860
50	G. E.	RC35	700
40	Cr-Wh.	CMC	1750
50	G. E.	CO2004	600
35	Cr-Wh.	CM351	700
30	G. E.	MD104½	725
30	Cr-Wh.	CCM	440
25	G. E.	CD93	1200
25	G. E.	RC32	800
25	Westgh.	SK100L	1100
25	Westgh.	SK133	575

Many others—1 HP and up
Also Variable-Speed and 115 Volts

AC SYNCHRONOUS

GENERATORS

3 Phase, 60 Cycle, 220 or 440 Volt (*2200 volts or higher)

KVA	Make	Type	P.F.	Spd
3500	*G. E.		.8	720
1750	*Westgh.		.7	900
1500	G. E.	ATI	.8	720
312	G. E.	ATI	.8	900
300	*G. E.	ATI	.8	720
225	G. E.	ATB	.8	600
187	Westgh.	ES	.8	720
112½	*G. E.	ATB	.8	1200
110	Cr-Wh.	103	.8	900
100	*G. E.	ATB	.8	900
60	Fbks-M.	B	.8	900
55	G. E.	ATB	.8	1200
50	G. E.	ATB	.8	1200
50	Westgh.		.8	1200
50	G. E.	ATB	.8	900

Phone: CAnal 6-2900

CHICAGO Electric Co.

1320 West Cermak Road, Chicago 8, Ill.

CHICAGO ELECTRIC does a thorough rebuilding job. Another example of this is shown in the photo at the left . . . a 1000 H.P. Slip Ring Mill Motor. The illustration shows the motor stripped down preparatory to rewinding. Skill, quality materials and pride of workmanship go into every Chicago Electric job. . . . Equipment rebuilding at its finest.

In addition to this outstanding rebuilding and repair service, Chicago Electric maintains one of the nation's largest stocks of guaranteed rebuilt power equipment. Whatever you need in the line of AC & DC MOTORS, M. G. SETS, GENERATORS, CONVERTERS, COMPRESSORS, HOISTS and other allied equipment you'll be sure to find it at CHICAGO ELECTRIC.

M. G. SETS

KW	Make	AC	DC
2400	A C.(3-unit)	4800	525
2400	Westgh. "	4800	600
1000	G E. "	11000	137½/275
1000	Westgh. "	11000	137½/275
500	A. C.-West.	2300	250
500	Cr-Wh.	220/440	250
450	G. E. (3-unit)	2300	125/250
400	A. C.	2300	120/240
250	West.-G. E.	440	250
200	Ridgeway	2200	250
150	G. E.	2300/440	250
150	G. E.	2300/4000	125/250
150	G. E.	440	275
100	G. E. (25 cy)	440	125
100	G. E.	2300	250
100	Delco-G. E.	440	120/240
90	G. E.	440	60
75	A. C.	440	250
60	A. C.	2300	110
60	G. E.	440	250
40	Cr-Wh.	220	125
40	A. C.	220	125
40	G. E.	220	125
35	G. E.	440	125
25	Westgh.	2200	125
25	G. E.	220	275
20	G. E.	440	250
20	Bogne-GE	440/550	250
20	Bogne-GE	220/440	250
20	Bogue-GE	220/440	125

DC to AC

100	G. E.	230	235
75	Westgh.	2300	110
12½	Westgh.	240	115

WE WILL BUY

YOUR SURPLUS MOTORS
GENERATORS • M.G. SETS
HOISTS • COMPRESSORS
TRANSFORMERS
CASH or TRADE

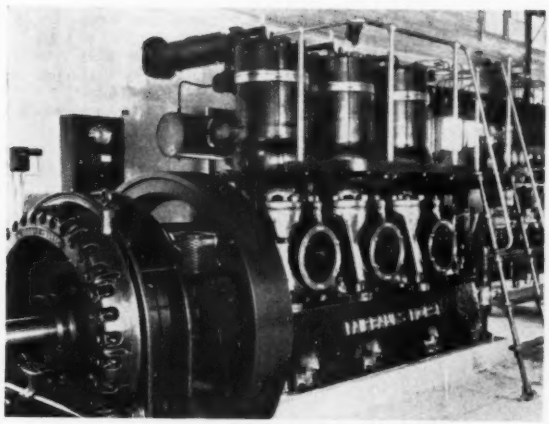
Write full details for our OFFER BY RETURN MAIL

AIR COMPRESSORS

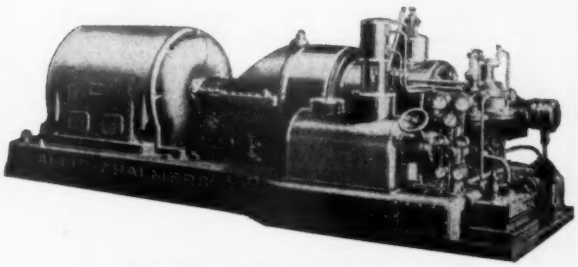
Size	Make	Type	Psi.	Disp.
12x11	Worth.	HB	100	426
10x11	Worth.	HB	100	294
9x9	Worth.	HB	100	211
8½x9	Worth.	HB	100	170
7x7	Worth.	HB	100	122
	Worth.	M-50	80-125	284
	Worth.	M-25	80-125	142
7½ HP	Worth.	AT833	100	35
10 HP	Worth.	AU933	100	48.8
5 HP	Worth.	3-TT	100	25.3
3 HP	Worth.	AS-8	100	17
2 HP	Worth.	2-TT	100	10.7
2½x2½	Quincy		150	5

Special Bargain Offerings

TURBO GENERATORS
DIESEL GENERATORS
UNAFLOW UNITS



185 KVA FAIRBANKS MORSE
DIESEL GENERATOR — INSTALLED 1948



937 KVA ALLIS CHALMERS 480 VOLT
NON CON. UNIT

TURBINE GENERATOR UNITS

Condensing—3 phase, 60 cycle

30,000 KW G.E. 12,000 volts, 235# PSI, 570°TT.

6250 KVA G.E., 5-stage, 2300/4160 volts, 200# PSI, 600°TT.

6250 KVA Westghse., 480 volts, 400 PSI, 15# G. extract with condenser.

5000 KVA Westghse., 600 volts, 275 PSI, 25#G, extract with condenser.

4000 KVA Allis 2300 volts, 200 PSI.

3750 KVA Westghse. 2400/4150 volts, 350 PSI.

2500 KVA G.E., 2300/480 volts, 3600 RPM, generator **LESS TURBINE.**

1250 KVA Allis, 480 volts, 250 PSI, 25# G. automatic extraction.

1000 KVA G.E., 450 volts, 275-400 PSI, 750°TT geared unit.

940 KVA Westghse., 2300 volts, 180 PSI, mixed pressure automatic extraction.

940 KVA Elliott, 2300 volts, 3600 RPM generator **LESS TURBINE.**

625 KVA Elliott 2300 volts, 250 PSI.

Non-condensing—3 phase, 60 cycle

5000 KVA G.E., 13,800 volts, 600 PSI.

1563 KVA G.E. 480 volts, 200 PSI, to 20# ga. back.

1250 KVA (2) G.E., 2300 volts, 150 PSI, 10# gauge back.

937 KVA ALLIS 480 VOLTS, 150#, 10# gauge back, excellent condition (photograph above).

625 KVA G.E., 2300 volts, 150 PSI, 40# gauge back.

500 KVA Terry, 480 volts, 325 PSI, 110# back.

125 KVA Westghse., 2400/480 volt, 125-250#, 5# ga. back. Geared unit.

UNAFLOW GENERATOR UNITS

3 phase, 60 cycle

625 KVA Westghse. 2300 volt connected Ames engine 150 PSI, 5# back.

575 KVA G.E., 2300 volts generator connected Nordberg engine 200# PSI.

375 KVA (2) G.E. 2300/480 volt connected Skinner engine 125 PSI, 8# back. Modern.

375 KVA Westghse. 600 volts connected Skinner engine, 150 PSI, 10# back.

312 KVA G.E. 240 volts connected Skinner engine, 125 PSI, 5# back.

SPECIALLY PRICED

- **9000 sq. ft. Condenser Engineering, 7000 sq. ft. and 5000 sq. ft. Wheeler surface condensers.**
- **12000 GPM, 25' hd. Worthington circulating pump direct connected to 200 HP, 3/60/2300 volt G. E. motor.**
- **6000 GPM Dayton-Dowd circulating pump, 70' hd. direct connected to 125 HP, 3/60/2200 volt G.E. motor.**
- **3500 GPM Allis dual drive circulating pump, 70' hd. direct connected to 75 HP, 3/60/440 volt Allis motor.**
- **5000 KVA Westghse. synchronous condenser 3 phase, 60 cycle, 4000 volts 720 RPM.**
- **150,000# per hr. B&W (2) cross drum water tube boiler 250# pres. 125°F superheat, Taylor Stoker.**
- **547 HP B&W Sterling water tube boiler 225# pres. built 1938.**
- **2—190 HP Riley, Type RO water tube boilers, 250#, water walls, Westghse. stokers, installed 1941.**

DIESEL GENERATOR UNITS

3 phase, 60 cycle

1250 KVA G.E., 2300 volt generator connected to 5-cylinder Nordberg engine.

1000 KVA G.E. 2400 volts, generator connected to Enterprise engine.

937½ KVA G.E. 2400 volts generator connected General Motors engine.

750 KVA G.E. 2400 volts, generator connected to Enterprise engine.

500 KVA Allis 2300 volts, 225 RPM connected to Nordberg Engine.

375 KVA F.M. 2300 volts, 300 RPM.

375 KVA E.M. 480 volts, 600 RPM generator connected Buckeye engine.

250 KVA (2) Westghse. 220/440 volts connected to Buckeye engine.

185 KVA F.M. 2300 volts, 300 RPM connected Fairbanks 32-E-14 engine installed 1948—guaranteed (photograph above)

20 KW Louis Allis, 125 volts D.C. generator connected 64 HP Hill engine.

DIRECT CURRENT UNITS

540 KW Westghse. non-condensing turbine 250 volts D.C. NEW, 200# PSI.

400 KW G.E., 3-wire, 250 volts, 360 RPM generator connected Skinner vertical engine 150 PSI—5# back.

300 KW Westghse. 3-wire, 250 volts 150/250# PSI noncond. turbine.

100 KW G.E. 120 volts condensing or non-condensing geared 200-275 PSI.

60 KW (6) Elliott 125 volts condensing or non-condensing 200-250 PSI.

UMC UTILITIES MACHINERY CORP.
1965 EAST 6th STREET • CLEVELAND 14, OHIO • CH. 1-0210

RE-NU-BILT BELYEA MOTORS

THE TRADE MARK WITH A MEANING SUCCESSFUL OPERATION GUARANTEED

*45th Year of Service—Member of A.R.A.**

A. C. MOTORS

3 ph. 60 Cycle

SYNCHRONOUS

Qu.	HP	Make	Type	Volts	Speed
1	5000	Whse.		2500/5000	600
1	4350	Cr. Wh.		4160/13800	514
2	3500	G. E.	TS	2300	257
1	2500	G. E.	ATI	2300	720
2	2100	G. E.	ATI	2300	360
2	2000	Whse.		2300	120
2	1750	G. E.	ATI	2300	3600
3	735	G. E.	ATI	2200/12000	600
1	500	Ideal	SM	2300/4150	1800
1	450	Whse.	Eng.	2200	128.5
1	450	Whse.		2300	450
2	350	G. E.	TS	2200	150
1	300	Whse.		2300	720
1	150	Whse.		440	600

SLIP RING

1	1800	G. E.	MT-498	2300	360
1	1500	ABB		2300	720
1	1200	G. E.	MF-26	2300	275
2	1000	A. C.	Mill	2300	240
1	500	Whse.	CW	500	360
2	500	G. E. unused	M-574Y	2200	900
1	500	G. E.	IM	440	900
1	400	Whse.	CW-1218	2200	435
1	400	Whse.	CW	440	514
1	350	G. E.	MT-442Y	2300/4000	253
2	300	G. E.	MT-565Y	2300	900
1	300	A. C.		440	505
1	250	G. E.	MT-424Y	4000	250
1	250	G. E.	MT-559S	2200	1750
1	250	A. C.		550	600
1	200	Cr. Wh.	26QB	440	505
1	200	G. E.	IM	410	435
1	200	G. E.	MTP	410	1170
1	200	Whse.	CW	410	490
1	200	G. E.	IM	440	600
1	150new	Whse.	CW	2300	450
1	150	G. E.	IM-16	440	600
2	125	A. C.		440	865
1	125	A. C.		440	720
4	125	G. E.	MT-566Y	440/2200	435
2	100	G. E.	IM	440	600

SQUIRREL CAGE

2	650	G. E.	FT559BY	440	3750
2	450	Whse.	CS	2300/4150	354
1	200	G. E.	IK-17	400	580
3	200	G. E.	KT-557	410	1800
1	200	G. E.	KT-559Y	2300	1200
1	200	G. E.	IK	440	865
1	75/150	G. E.	IK	440	450/900
1	150	Whse.	CS	440	580
1	150	Wstghse.	CS8556S	410	830
1	125	Whse.	MS	440	485
1	125	G. E.	KF-TEFC	440	3585
2	125	At. Ch.	ARW	2200	1750

D.C. MOTORS

Qu.	H.P.	Make	Type	Volts	Speed
1	2200	G. E.	MCF	600	360/500
1	2000	Whse.	Mill	600	230/460
1	910	Whse.	QM R Brg.	250	140/170
1	900	Whse.		250	450/550
1	825	Whse.	Mill	250	90/180
1	600	A. Ch.	MILL	230	400/800
1	500	Whse.	Mill	600	300/900
2	450	Whse.		550	415
1	400	G. E.	MCF	550	300/1050
1	300-400	G. E.	DYNA	250	1325/2500
2	300	Whse.	CB-5094	230	575/1150
1	200/300	G. E.	MPC	230	360/920
1	250	G. E.	MPC	230	400/500
1	200	Rel.	1970T	230	720
1	200	Whse.	CB-5113	230	400/800
1	150	G. E.		600	250/750
8	150	Cr. Wh.	83H	230	890
1	150	Cr. Wh.	CMC-65H	230	1150
1	150	Whse.	SK-201	230	360/950
1	150	Whse.	SK-151 B	230	900/1800
1	150	Whse.	CB-2073	230	525/1150
1	50/120	G. E.	MFC	230	250/1000
2	100	Whse.	SK-181	230	450/1000
1	60	Kl. Dy.	25-S	230	525/1050
2	50/60	Whse.	SK-170	230	400/1200
1	50	G. E.	CO-1810	230	725
1	50	Whse.	SK-170	230	350/1050
2	50	G. E.	RCF-31B	230	1700

MOTOR GENERATOR SET

3 ph. 60 Cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1	2000	G. E.	514	600	13800/4000
2	2000*	G. E.	500	600	6600/11000
3	1500	G. E.	514	250	4000/13200
1	1500	G. E.	720	600	6600/13200
1	1500	G. E.	360	275	2300/4400
1	1500	G. E.	600	600	2300/4150
1	1500	C. W.	514	115	4160/13800
1	1200	A. C.	720	550	2300
2	1000	Whse.	900	600	2300/4100
1	1000	G. E.	900	260	6600
1	1000(3U)	G. E.	900	250	2400/4800
2	750	Whse.	900	275	2300/4160
1	750	C. W.	514	115	2300
1	600	G. E.	720	250	440/2300
1	500	Whse.	900	125/250	440
1	500	Whse.	900	250	6600/13200
1	500	Whse.	1200	125/250	2300
1	500	G. E.	720	125	2300/4000
1	400	G. E.	720	250	440/2300
1	400	Whse.	1200	250	2300
1	150	G. E.	1200	250	2300
1	150	Whse.	1200	275	2300
1	150	G. E.	1175	125	440
1	140(3U)	Cr. Wh.	690	125/250	2300
1	125	G. E.	1200	125	440
1	100	Delco	1200	125/250	440
2	35	Whse.	1750	125/250	2200

FREQUENCY CHANGERS

Qu.	KW	Make	Cycles	Voltage
1	3000	G. E.	25/60	4000/2300x2300/4000
1	2000	G. E.	25/62½	2300/4160
1	2000	Whse.	25/62½	2300/2300
1	1000	G. E.	25/58	4400/2300
1	500	A. C.	25/60	11000/2300V

TURBO GENERATORS

Qu.	KW	Make	Desc.
1	1000	Moore	Auto-Ext. Cond. 175/200# I.S.P. 5/20# G. Ext. Surface Condenser—3/60/2300.
	1000	G. E.	Non-condensing 175/200 lbs. I.S.P. 5/20 lbs. G.B.P., 480/3/60.
	750	G. E.	Condensing 425#-725*TT I.S.P. 440 V. 3 ph. 60 cy. New—1944
	750	Whse.	Non-condensing 135# I.S.P. 40# B.P. 750 Kw. 280 V. D.C.
	500	Moore	Non-condensing — 150/200 lbs. ISP 5/35 lbs. G.B.P.—3/60/480 volts direct connected exciter.
	500	G. E.	Non-condensing 175/200 lbs. I.S.P., 5/30 G.B.P., 480/3/60.
	400	Whse.	Non-condensing 125/150# I.S.P. 5/10# G.B.P., 240/480v. 3 ph. 60 cy.
	300	G.E.	Non-condensing 10/175# I.S.P. 5/15# B.P. 480V. 3 ph. 60 cy.
	200	Whse.	Non. condensing 150# I.S.P. 7# B.P. 240 V. 3 ph. 60 cy.

TRANSFORMERS

60 Cycles

Qu.	KVA	Make	Type	Ph	Voltages
1	2500	Whse.	OISC	3	26400/13200x460
3	2000	G. E.	HVDDJ	1	66000x13800
3	1000	G. E.	H	1	2200x480
1	1500	G. E.	HT	3	13200x2300
1	1250	G. E.	H	1	6600x550
1	1150	A. C.	OISC	3	13200x2300/480
2	1000	Pitts.	OISC	3	2300x460
1	500	Whse.	OISC	3	13400x216
2	300	G. E.	HT	3	2400x240/480
3	200	Whse.	O15C	1	13200x120/240
3	150	Whse.	OISC	1	33000x2300/4000
3	100	G. E.	OISC	1	2400x120/240
2	75	Upte	OISC	3	4160x240
1	50	Mol.	Askerel	3	13200x120/208
3	25	A. C.	OISC	1	4000x230/460
3	10	G. E.	H	1	2300x115/230
9	7½	G. E.	H	1	2300x115/230

*American Rebuilders Association — Member Body of A.S.A.

BELYEA COMPANY, INC.

OFFICE AND SHOP

43 HOWELL ST., JERSEY CITY 6, N. J.

PHONE JO 2-3334 — N. Y. CITY LINE RE 2-7150

TRANSFORMERS FOR SALE

6—1000 KVA Mol. 11500—2400/4160Y
3— 500 KVA Pitts. 22000—2300/4000Y
3— 500 KVA G-E 22000—2300/4000Y
3— 333 KVA W-H 6600—2300
3— 200 KVA G-E 22000—2300
3— 200 KVA Mol 3450—2300
3— 150 KVA G-E 44000—600/2400
3— 150 KVA G-E 19050/33000Y—2540/4000Y
3— 150 KVA A-Ch. 13800—2400/4160Y
2— 150 KVA G-E 6900—230/460
3— 100 KVA G-E 33000—6900/11950Y
3— 100 KVA G-E 13200—2300
3— 50 KVA A-Ch 33000—6900/11950Y
3— 50 KVA A-Ch 33000—2400/4160Y
3— 50 KVA A-Ch 13200—2300/4600

Many other items in stock

TRANSFORMERS WANTED

Reliable rewind and repair service on all makes of transformers

THE ELECTRIC SERVICE CO.
CINCINNATI 27, OHIO
40 Years Dependable Service

COMPLETE DIESEL PLANT

3—Fairbanks Morse units. 805 HP—556 KW; 690 HP—473 KW; 300 HP—200 KW. Model 33-E-14. 3/60/2400 volts. New 1940. Will sell all or part. With auxiliaries. Condition excellent.

MISSISSIPPI VALLEY EQUIPMENT CO.
507 Locust St. St. Louis 1, Mo.

REFRIGERATION UNITS

TWO PRACTICALLY NEW WORTHINGTON CARBONDALE

REFRIGERATION COMPRESSORS

300 Ton Freon

Ideal for large plant or office building

WILL SACRIFICE

WINSTON MACHINERY CO., INC.
326 WEST OHIO STREET
INDIANAPOLIS, INDIANA

FOR SALE

18 NEW TURBINES

4 horizontal, 14 vertical, Westinghouse

Driving forced draft blowers—capacities ranging from 39000 to 56000 CFM and 16" to 24" pressure. Steam pressures 360 to 575#, back pressure 10#.

Will sell turbines separately if desired. *Price reasonable.*

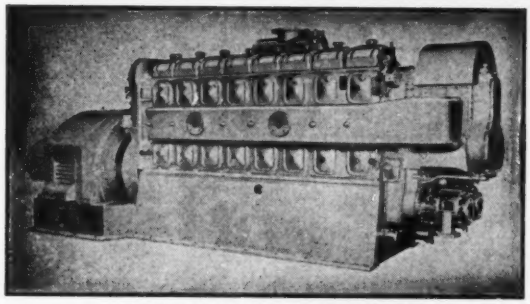
Also—1—250 KW GE turbo generator unit, 3 phase, 60 cycle, 440 volt. Used one year.

G. M. DeROSE
2457 WOODWARD AVE.
408 DONOVAN BLDG.
DETROIT 1, MICH.

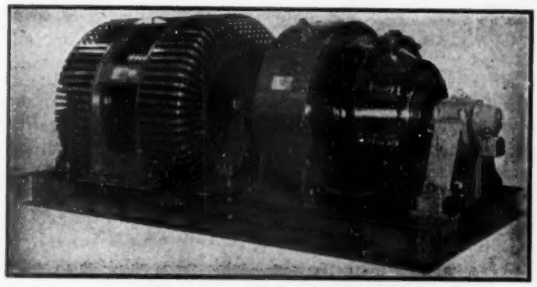
"THE O'BRIEN STORY"

KNOWLEDGE . . . FACILITIES . . . CAPITAL . . . EXPERIENCE . . . these are the requisites around which The O'Brien Story is built. With over 37 years of experience and know how in Manufacturing, Rebuilding, Reconditioning and Distributing Industrial Machinery of all types The O'Brien Machinery Company has expanded until today we are, in addition to being Philadelphia's leading Machinery dealers and exporters, one of the nation's outstanding Machinery houses. Our facilities consist of over 100,000 sq. ft. of fully equipped shops and warehousing space manned by our complete staff of graduate mechanical and electrical engineers, competent buying and selling personnel, trained electricians and skilled machinists. Our representation is both national and international, and our service facilities are linked from coast to coast. The name O'Brien in the machinery industry stands for quality and integrity which is the keynote of our success. "Know the integrity of your dealer and you will know the quality of your machinery."

Read More About "The O'Brien Story," In the next issue of Power.



375 KVA GM DIESEL GENERATOR SET



500 KW WEST. MOTOR GENERATOR SET

MOTOR GENERATOR SETS

1500 KW G.E. 250 Volt 3/60/2300/360 RPM
1—1000 KW West. 250 volt Flat Compound 500 RPM 1440 H.P. West. Syn. Mtr. .8 P.F. 3/25 cycle 2300 V. A.C. & D.C. Panels
1—500 KW Westinghouse 250 Volt 900 RPM with 720 H.P. West. Syn. Motors 3/60/6600/13200 volt, Serial #813047 (year 1935) See actual photo above.
1—500 KW Crocker Wheeler CCD, 250 volt 720 RPM with 750 KVA Cr. Wh. Syn. Motor 3/60/2300 V. A.C. & D.C. Panels.
1—300 KW West. 3 wire 125/250 Volt 1200 RPM Generator (1938 year). Can furnish with suitable motor. Advise Requirement.
200 KW Elliott 250 Volt 1200 RPM 3/60/ Any Voltage.
2—150 KW G.E. Type MPC—250 Volt 1200 RPM 3/60/2300/200 H.P. Syn. Motor Drive A.C. & D.C. Panels
100 KW Electro Dynamic 200 V. 3/60/220/1200 B. Brg. Sq. Cg. Sep. Excited.
1—100 KW Al. Ch., 250 V. 1200 RPM 150 H.P. Syn. Mtr. 2/60 or 3/60 any voltage.
1—100 KW G.E.—C.D.—125 Volt D.C. 150 HP GE Syn. Mtr., 3/60/220/440/1200 RPM.
1—75 KW Burke 250 V. 900 RPM 113 H.P. Burke—Syn. M.D. 2 or 3 ph, any voltage.
2—50 KW GE 500 Volt DC, 75 HP, 3/60/440/1200 RPM.
Smaller Sizes and Types—Advise Requirements

1—New O'Brien "Red-Line" 750 KVA OISC Transformer 13,200/13,800 v. pri., 480 v., sec., 3 ph.
3—333 KVA New O'Brien Red Line O.I.S.C. Transformers 4160 V primary 480 V secondary ea. single phase 60 cyc.

OISC TRANSFORMERS

Qu.	KVA	Make	Pri. V.	Sec. V.	Phase
3	1000	GE	13200	2300	1
1	1000	Penna.	13200	480	1
1	1100	West.	4160	440	3
3	750	West.	2300	230	1
3	500	GE	13200	2300	1
3	333	(New)	2400	480	1
3	333	GE	13200	2300	1
3	250	West.	13200	2300	1
3	200	GE	7200	120/240	1
3	200	GE	13200	2300	1
3	200	Mal.	2300	220/440	1
3	200	GE	13200	2300	1
3	200	GE	7200	2300	1
3	150	GE	33000	220/440	1
3	150	Ning.	2400	240/480	1
3	100	West.	11000	480	1
3	100	GE	7200	120/240	1
2	100	GE	2300	115/230	1
3	75	Mal.	2300	115/230	1

DIESEL & GASOLINE GENERATOR SETS

1—1250 KVA Nordberg 3/60/2300/360 RPM 1940
6—875 KVA G.E.—Busch Sultzer 3/60/2300/275 RPM, Complete Plant, 1940
1—375 KVA GM 8-268A, 3/60/480/1200 RPM
1—250 KVA G.M. Twin 6-71, 3/60/220/440/1200 RPM Rad. Cooled.
1—187 KVA G.M. Twin 6-71 Portable, 3/60/220/440 New
1—125 KVA Hercules. 3/60/220/440/1500 Hrs.
1—56 KVA Climax Gasoline, 3/60/220/1200.
2—45 KVA Chry. New 6 Cyl. 3/60/220/440.
1—200 KW G.M. Twin 6-71, 240 D.C. Rad. Cooled Elec. Start.

ELECTRIC MOTORS

Qu.	HP	Make	Type	Volts	Speed
1	1000	G.E.	K	2300	1800
1	1000	West.	CW	2300	450
1	600	West.	CS	2200	600
1	500	AC	ARX	2300	1800
1	500	West.	CS	6600/2300	514
1	450	A.C.	ANY	2300	600
2	400	G.E.	IK	2300	1800
1	400	West.	CW	440	514
1	400	G.E.	Syn.	2300	450
1	350	G.E.	MT18	2300	400
1	250	G.E.	IM	2300	450
1	200	G.E.	IM	440	600
1	125	West.	Syn. 3 brg.	550	600

EXCEPTIONAL DELIVERY
New O'Brien mfrd. Red Line dry type Transformers to 150 KVA single phase, 300 KVA, 3 phase—4800 V. Pri—& Phase Changers to 100 KVA.

ELECTRIC MOTORS (Con't)

2	100	G.E.	KT352	220/440	1200
2	100	G.E.	Syn.	440	300
1	100	G.E.	KT543	440	1800
1	50	West.	CS	440	3600
1	50	West.	CS	440	1200

TURBO GENERATORS

1—1250 KVA DeLaval Non-Cond. 3/60/2300. New 1940 240 psi 50 lb. B.P.
1—780 KVA G.E.-Moore 3/60/2300/3600 RPM Non-Cond. 180 PSI 35 lb. B.P. New 1936.
1—500 KVA West. Non-Cond. 3/60/220/440, 150 PSI 10 lb. B.P.
1—200 KVA Moore Non-Condensing 3/60/480, 195 PSI, 100° F, 100# BP. Year 1936.
1—187 KVA West. Non-Cond. New 1930 3/60/440 110 psi 10 lb. B.P.
1—94 KVA Worthington Non-Cond. 3/60/220 140 psi 5 lb. B.P.
1—75 KW G.E. Non-Cond. D.C. 125 volt.

PLATING, ANODIZING SET

1250 amps 15 V. 900 rpm Columbia 30 HP Sq. Cage Motor 3/60/220 Direct Drive Complete on base with DC Panel.

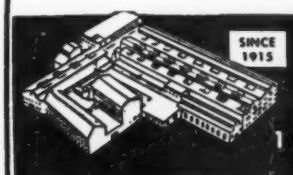
AIR COMPRESSORS

1—12,000 CFM I.R. Turbo 3.25 lb., direct 250 H.P., 440/3/60/3600.
1—5600 CFM I.R. PRE-2, 42/25½x30, 100 lb. direct 930 HP Syn. 1 P.F. 2300/60/3.
1—4690 CFM I.R. PRE-2 48/24x27 100 lb. direct 804 HP Syn. .8 PF 2300/60/3.
1—1600 CFM Sullivan WJ 8 Angle Cpd. 100 psi 22/13x16 belt.
1—978 CFM Sullivan 13x13x8, 45 psi.
1—900 CFM CP 100 lb. 9CP Portable Diesel Compressor, Pneu. tires.
1—868 CFM Sullivan 17x10x12, 100 psi.
1—528 CFM Ing. Rand 14x12, 100 psi.
1—215 CFM Penna 5A, 70 psi—V-Belt
1—368 CFM Chi. NSB, 12x10, 100 psi.
1—371 CFM Schramm 7⅛x5x4, 100 psi

BOILERS

1—390 HP Springfield 300 lbs.
2—363 HP Springfield 250 lbs.
2—300 HP Riley R. O. 250 lbs.
1—150 HP Keller C.P. 160 lbs.
1— 60 HP Ames Package 125 lbs.
1— 60 HP Ames Package 125 psi, 1947.

"Everything from a Pulley to a Powerhouse"



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Each Schoonmaker-sold Diesel Engine Unit is fully REMANUFACTURED in our plants by highly skilled, factory-trained Diesel engineers. Only genuine factory-made and approved parts are used and all REMANUFACTURING is in strict accordance with manufacturer's recommended procedures. Prior to shipment every engine is subjected to a FULL LOAD operating test in accordance with DEMA standards.

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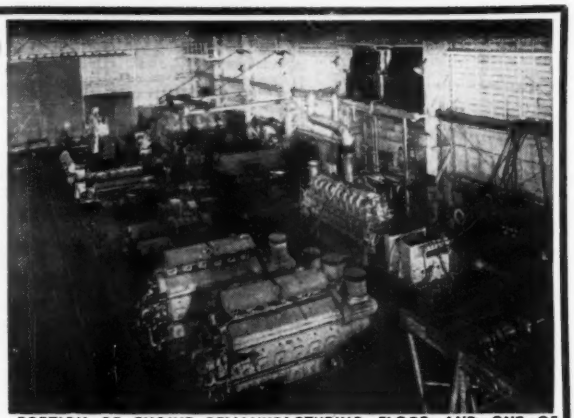

PORTION OF ENGINE REMANUFACTURING FLOOR AND ONE OF THE ENGINE TEST STANDS AT OUR SAUSALITO, CALIF. PLANT.

A PARTIAL LIST OF OUR INVENTORY

KW	MAKE	MODEL	HP	RPM
1980	Nordberg	TS-217	3000	225
1136	Fairbanks Morse	38D	1600	720
1100	General Motors	16-278A	1600	720
1000	General Motors	16-567B	1440	720
750	General Motors	12-567	1080	720
500	General Motors	8-278A	750	720
500	Baldwin	VO-8	750	514
500	Alco	6-12½x13T	750	600
500	General Motors	8-567	720	720
400	Ingersoll-Rand	S-8	600	720
350	Baldwin	VO-6	510	450
320	Enterprise	DSG-6	460	450
300	General Motors	8-268A	450	1200
250	Fairbanks Morse	33-D	375	360
200	General Motors	8-268A	350	900
167	Ingersoll-Rand	S	255	600
160	Buckeye	80	240	600
150	Worthington	CC-4	225	450
100	General Motors	3-268A	150	1200
100	Worthington	BB-5	150	600
100	Fairbanks Morse	38E	150	1200
60	General Motors	6-71	90	1200

ALTERNATING AND DIRECT CURRENT UNITS
STANDARD AND SPECIAL VOLTAGES AS REQUIRED

ONE YEAR GUARANTEE!

FOR SALE

IMMEDIATE DELIVERY

2—FAIRBANKS-MORSE, Diesel Opposed Piston, 38D8 ⅛, 1600 HP., @ 720-RPM., at 800 RPM., 1800 HP., Port and Starboard Engines: Complete, all Auxiliaries: With or without Reduction Gears. Serials, 841558, 841559.

Lloyd's (London) Inspection Report on Request.

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CHARLES WEAVER
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BOILER FEED PUMPS

1—Lecourtenay 675 G.P.M., Type 4M 8B, 5 stage, 1100 Ft. Hd.
1—Worth. 740 G.P.M., type WCS-2, 5", 2250 Ft. Hd.
1—Worth. 700 G.P.M., type UNS-1, 6 stage, 6". 1550 Ft. Hd.
2—I. R. 200 G.P.M., 2", 1375 Ft. Hd.
Pumps above are mounted on basis for motor or turbine drive.

We have about 200 various size cent. pumps on hand, turbine, motor, and gasoline driven. Send us your inq.

DALTON SUPPLY CO.
2829 Cedar St. Phila. 34, Pa.

POWER EQUIPMENT

BOILERS

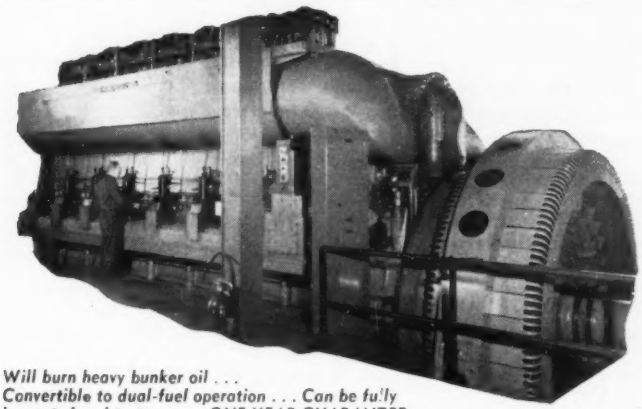
3—#587 Kewanees Comp. Plant. new 1946 150 HP ea. 100#

MERRILL and COMPANY
407 S. Dearborn St. Chicago 5, Ill.
Telephone HArrison 7-8289

CURRENT MODEL·· DIESEL

1980 KW NORDBERG MODEL TS-217 DIESEL UNIT

Heavy Duty • Slow Speed • Available Immediately



Will burn heavy bunker oil . . .
Convertible to dual-fuel operation . . . Can be fully inspected and test run . . . ONE YEAR GUARANTEE

ENGINE: (2800 BHP net) Nordberg, 7 cylinder, 2 cycle Diesel engine at 225 RPM, 21½" bore, 29" stroke, cylinders arranged vertical in line, solid injection.

GENERATOR: 1980 KW, 2475 KVA General Electric generator, 2400/4160/6900 volts, 3 phase, 60 cycle service at 225 RPM.

(50 cycle rating 1650 KW at 187 RPM)

UNIT AUXILIARIES AND ACCESSORIES

Complete standard engine auxiliaries and accessories including filters, strainers, pumps, gauge board, pyrometer, thermocouples, exhaust muffler, lubricating oil cooler, Young evaporative type cooler for jacket water cooling, thermostatic control valve, fuel oil day tank with transfer pump and oil meter, 2 lubricating oil storage tanks, lubricating oil transfer pump, Diesel-driven air starting unit, air tanks, air intake filter, special engine tools, all station piping, including flanges, adapters, valves, and fittings, for air intake, exhaust, water, lubricating oil, fuel oil, and air. Generator and exciter control switchgear.

The unit above affords a rare opportunity to procure a complete, modern current model, heavy duty, slow speed diesel set at a great saving. It represents an offering which cannot be duplicated anywhere in the diesel market today.

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TURBINE GENERATOR UNITS
3 Phase 60 Cycle

32500 KVA G.E. Cond. 250 lbs. 12000/13200 volts.
12500 KVA West. Cond. 200 lbs. 2400 volts.
7500 KVA A.C. Cond. 200 lbs. 2300 volts.
5000 KVA G.E. Non-cond. 600 lbs.—125 lbs. extr. 50 lbs. exh. 13,800 volts.
5000 KVA West. Cond. 400 lbs.—125 lbs. extr. 25 lbs. exh. 480 volts.
5000 KVA G.E. Cond. 400 lbs. 2300/4000 volts.
3125 KVA West. Cond. 400 lbs. 2400/4160 volts.
2500 KVA West. Cond. 200/400 lbs. 2400 volts.
1563 KVA G.E. Cond. 150 lbs.—15 lbs. extr. 480 volts.
1250 KVA West. Non-cond. 150 lbs.—30 lbs. exh. 480 volts.
1250 KVA West. Cond. 250 lbs.—125 lbs. extr. 480 volts.
938 KVA West. Cond. 250 lbs.—45 lbs. extr. 480 volts.
625 KVA G.E. Non-cond. 175 lbs.—30 lbs. exh. 2300 volts.
187 KVA West. Non-cond. 150 lbs.—15 lbs. exh. 480 volts.

DIESEL GENERATOR UNITS
3 Phase 60 Cycle

1000 KVA DeLaVergne, 2400 volts 200 RPM.
856 KVA DeLaVergne, 2400 volts 240 RPM.
651 KVA Superior, 2400 volts 327 RPM.
413 KVA Fairbanks-Morse, 2400 volts 514 RPM
375 KVA Worthington, 2400 volts 327 RPM.
250 KVA Worthington, 240 volts 327 RPM.
150 KVA Fairbanks-Morse, 240 volts 360 RPM.
75 KVA Winton, gasoline, 240/480/2400 volts 1200 RPM.

UNIFLOW GENERATOR UNITS
3 Phase 60 Cycle

750 KVA Ames vert., 175 lbs. 240/480/2300/4160 volts.
500 KVA Swinner hor., 150 lbs. 240 volts.
312 KVA Skinner hor., 150 lbs. 240 volts.
210 KVA Skinner hor., 150 lbs. 240 volts.
156 KVA Skinner hor., 150 lbs. 240 volts.

STEAM BOILERS

150,000 lbs. per hr. B.&W., 250 lbs., coal.
100,000 lbs. per hr. B.&W., 450 lbs., stoker coal.
50,000 lbs. per hr. B.&W., 450 lbs. pulv. coal.
30,000 lbs. per hr. C.E., 250 lbs., oil or gas.

SYNCHRONOUS MOTOR GENERATORS
3 Phase 60 Cycle

3,000 KW G.E. 13200 volts AC—250 volts DC.
2,000 KW A.C. 2300 volts AC—250 volts DC.
1,875 KW G.E. 13200 volts AC—250 volts DC.

TRANSFORMERS
60 Cycle

10,000 KVA (1) A.C. 3 ph., 12000-2400/460 volts.
6,000 KVA (1) Pgh. 3 ph., 11000-2300 volts.
5,000 KVA (1) A.C. 3 ph., 12000-2400/4160 volts.
2,125 KVA (3) G.E. 1 ph., 13200-2300/4000 volts.
1,000 KVA (2) Pgh. 3 ph., 2300-460 volts.
500 KVA (3) Pakd. 1 ph., 13200-1100/220 volts.

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7 x 7 AIR COMPRESSOR

Ingersoll Rand 7x7 Class ERI—100#—with or without drive.

1—400 KW Westinghouse 500 V. DC 750 RPM 800 Amps. Mater—580 H. P. Synchronous 3 Ph. 25 cycle 440 V. 750 RPM.

ANODIZING M.G. SET

33 KW Gen. Elect. Type BR. Form C 60 V. D.C. Direct connected to 50 HP 3/60/440/1800 Gen. Elect. Motor.

400 HP GEAR REDUCER

1—400 HP Nuttall (Westinghouse) Type LMR-25 Single Helical Heavy Duty Reducer—6-1 Ratio at 900 RPM with High Speed Shaft Extension for Brake.

400 HP SYNCH. MOTOR

1—400 HP Westinghouse Synchronous Motor. 3/60/2300/900 RPM. Unity P.F. with direct connected exciter—Late Type.

55" LIFTING MAGNETS

2—55" Cutler Hammer Magnets 250 Volts DC. Excellent Condition.

1—350 KW General Electric Generators Type MPC, 250 Volt DC, 720 RPM Single Bearing Machines.

MOTORS

60-50-25 Cycle in Stock—All Sizes. Slipring—Squirrel Cage—Synchronous. All types of Control Equipment.

100 HP Westinghouse Slipring 3 Bearing 3/60/220/440/435 RPM.

100 HP Gen. Electric Type I form K 3/60/2300/600 RPM.

100 HP Gen. Electric Type KT 356 3/60/2200/900 RPM.

125 HP Gen. Electric Type I form K 3/60/440/720 RPM.

125 HP G. E. Type KT 3/60/2300/1200 RPM.

150 HP G. E. Type KT 3/60/440/500 RPM.

150 HP Gen. Electric Type I form K 3/60/2300/900 RPM.

200 HP Gen. Electric Slipring Type I form M 3/60/440/600 RPM.

200 HP G. E. Type KT 3/60/440/600 RPM.

250 HP G. E. Type KT 3/60/440/720 RPM.

T.E.F.C. MOTORS

2—200 HP West. XP-3/60/2200/3600, Frame 8120H.

1—125 HP G.E., TEFCBB, Frame KF63282, 60/3/440/3600 RPM.

60 HP West. CS-607 3/60/440/900, X-Proof.

50 HP Ideal, New, 3/60/220/440/1800.

2—20 HP Louis Allis ES-365, 3/60/220/440/1800, X-Proof.

15 HP Louis Allis Ex-364, 3/60/220/440/1800, X-Proof.

125 VOLT DC MOTORS

1—100 HP Crocker Wheeler 125 Volt DC 850 RPM Ball Bearing

DC CIRCUIT BREAKERS

1—1000 AMP. Condit. 2 Pole

1—1600 AMP. Condit. 2 Pole

1—1600 AMP. Westinghouse 2 Pole

1—3000 AMP. Westinghouse 2 Pole

TRANSFORMERS

4—333 KVA Gen. Elect. Transformers Type H Form VRW Primary 2400/4800 Secondary 240/480 Single Phase 60 cycle with Taps. Immediate Shipment.

3—200 KVA Niagara—New. OISC. 1 Ph. 60 Cy. 2400/4160Y. 240/480.

1—75 KVA Niagara—New. OISC.—3 Ph. 60 Cy. 2400 V. Primary, 280Y/120 Secondary.

6—50 KVA. Niagara—New. Dry Type 1/60/-240/480—120/240.

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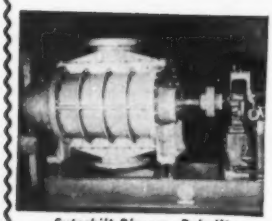
Exclusive Specialists in Rebuilding

BLOWERS • FANS • EXHAUSTERS



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Here is the *"largest stock in the world"* of blowers, fans, and exhausters—both new and rebuilt. Our 27 years' experience and factory-trained men assure you of the best in air-moving equipment. A partial listing is shown . . . write for our detailed list.

ROTARY-POSITIVE BLOWERS

Press. Max.	Cap. Max.	Make
10	215	Roots-Con.
10	128	Sutorbilt
6	5500	Roots-Con.
6	76	Sutorbilt
5	2130	Roots-Con.
3	650	Roots-Con.
3	366	Roots-Con.
3	124	Roots-Con.
3	69	Sutorbilt

80 others in stock.

TURBO BLOWERS

Volume c. f. m.	Static-oz.	Make
410	96	Allen-Billmyre
225	96	Allen-Billmyre
3700	32	N. American
3800	24	Spencer
10400	20	Ingersoll Rand
1500	16	Spencer
1100	16	N. American
1075	16	Spencer
1000	16	Spencer
100	16	Gen. Blower

60 others in stock.

CENTRIFUGAL FANS

Size	Type	Make
49	ME	New York
3¼	W	Clarage
8	I	Bayley
7	B/C	Bayley
6	LL	Buffalo
85	5V	Sturtevant
5½	HS	American
4	LL	Buffalo
1¾	W	Clarage
3½	AHS	American
4	M	Garden City

200 others in stock.

STEEL PLATE EXHAUSTERS

Size	Type	Make
80	SS	Allington-Cur.
70	ME	Sturtevant
50	SS	Buffalo
23	IE	Clarage
55	E	American
55	Des. 1	Sturtevant
30	SP	Garden City
49	SP	Buffalo
15	IE	Clarage
35	SP	Garden City

110 others in stock.

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(6) OIL FIRED B&W BOILERS

Cross Drum Sinuous Headed straight tube type. Heating surface 11417 sq. ft.—1141.7 HP—210 P.S.I.G. design pressure—200 P.S.I.G. working pressure—75,000 lbs./hr. capacity—steam temp., saturated—1024 cu. ft. furnace volume—200° feed water temperature.

(6) 300 KW TURBO GENERATOR SETS

120/240 volts DC—Joshua-Hendy turbine—250 lb. W.P. condensing. Suitable for pressures to 440 lbs. at 740°TT. Geared to 1200 RPM. 300 KW Westinghouse 120/240 volt 1250 amp. stabilized shunt generator. With switchgear. Built 1945. Excellent condition.

(4) **100 KW GM 3-268A** 440/60/3 AC generator sets.

(1) **100 KW LORIMER** 440/60/3 AC generator set.

(1) **100 KW FAIRBANKS-MORSE** opposed 440/60/3 AC generator set.

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Curtis 5050

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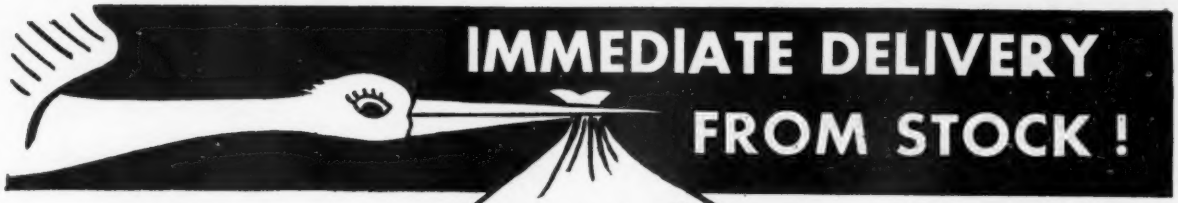
Power plant equipment, Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

PENN MACHINE COMPANY
Jackson, Miss.



SQUIRREL CAGE, OPEN 3 PHASE MOTORS

HP	RPM	VOLTS	DESCRIPTION
750	900	6600	Westinghouse
350	3600	2200	Westinghouse
300	1200	2300/440	Westgh., CS
300	900	440	G.E.
200	490	2200	G.E.,-I
125	3600	220/440	A-C
125	1800	2200	A-C
115	1200	440	G.E.
100	1800	2200	Westinghouse
100*	1200	2200	G.E.-KF544
100	1200	2300/440	A-C, AR.
100	720	440	Westgh. 3 Brg.
85	3600	2300	G.E.
60	3600	2200	G.E.
60	1800	2200	G.E.
50	3600	220/440	G.E.-4048
50	1800	220	Triumph
50	720	2200	Westinghouse
40	1800	220/440	West.-444
40	900	440	G.E.
40	720	440	G.E.
35	3600	220	G.E.-KT
35	600	440	G.E.

*New Motors

4 SPEED MOTORS AND CONTROL

Century, Model SCNM504Y901AV, 20 HP, 440 volt, 3 Phase, 60 Cycle, 1700/1120/870/560 RPM, Multi-speed, ball bearing. With plugging switch mounted on shaft: motors on adjustable hinge bases. Control —Allen Bradley, Magnetic.

SLIP RING MOTORS

HP	RPM	VOLTS	DESCRIPTION
400	514	440	West.-Cw
375	1800	2300	Al. Ch.
350*	514	440	G.E., TE, FC, BB
300	514	440	Al. Ch. 3 Brg.
250	600	2200	G.E.-117B
250	450	2200	C.-W.
250	450	2200	G.E.-I-17B
250	300	2200	Al. Ch.
200	1800	440	Al. Ch.
200	600	440	West.-CW
200	600	440	G.E.-1M
200	514	440	West.-CW
150	1800	2200	FM-HV
150	720	2200	Al. Ch.
150	600	220	Wagner
125	1750	2200	West., CW
120	900	550	Ideal
100	720	440	Al. Ch.
100	600	2200	G.E. MT-562
100	600	220	Wagner
100	400	440	West. Elec. (GE)

*New

Special

FREQUENCY CHANGER

2500 KW General Electric
2300 volt, 3 phase, 25 cycle,
4000 volt, 3 phase, 60 cycle,
300 RPM.

MOTOR GENERATOR SETS

D.C. OUTPUT KW	Voltage	Description	A.C. INPUT HP	RPM	Volts
1500	600	G.E., MCF	2100	720	13200
1200	525	Al. Ch.-G.E.	2000	720	2300
800	500	West., 3 unit	1200	1200	2300
600	250	Westgh.	1200	1200	2300
750	550	G.E.	1070	900	2300
750	500	Westgh.	1070	900	13200
750	250	Westgh.	1070	900	13200
600	250	Westgh. (2-300 KW Gen.)	1200	1200	2300
600	250	G.E.	900	900	2300
400	250	Westgh.-G.E.	600	1200	220/440
300	250	G.E.	450	1200	2300
200	125	G.E.,-Westgh.	300	720	2300
200	125	G.E. (25 cy.)	300	730	440
200	250	G.E.,-Westgh.	300	1200	440
100	250	Delco-Westgh.	150	1200	220
100	250	G.E.	150	1200	220/440
75	125	G.E.	115	1200	440
50	125	C-W	85	1800	440
47½	125	Al. Ch.	100	1200	2300
40	250	Westgh.-G.E.	60	1200	220/440
35	125	G.E.	50	1800	2200
22	125	Al. Ch.	33½	900	220
20	115	G.E.-Al. Ch.	30	900	220
15	250	Al. Ch.-L.A.	25	1800	220/440

PLATING AND ANODIZING SETS

D.C. OUTPUT AMPS	VOLTS	RPM	DESCR.	A.C. END HP	VOLTS	DESCR.
4000	2 to 8	425	Jantz & Leist			
2400	40/80	1200	Westgh.	290	440	WH Sync.
1500/750	6/12	1200	Munning			GE—
			Loeb	15	440	I Cage
1200	60	1160	Century	108	220/440	Century.
						SCN-584
1000	60	1200	Century	100	440	Century
						Cage
1000	6	1200	Wagner	—	—	—
800	30	900	C-W	40	220	C-W
						type 122Q
680	11	900	Westgh.	15	440	W.H. BB.
600	50	900	E-M	40	440	A-C
600	30	1200	W.-E	30	440	GE
600	30	900	G.E.	25	440	GE
500	40	1200	G.E.	30	440	GE-KT
500	12	1200	Ideal	10	220	GE-KT
500	6		GE Rect.	—	440	—
416	12	1200	HVW	7½	440	GE-KT
400	40	1800	Hebert	25	220/440	Hebert
208	62	1800	G.E.	20	220/440	GE-KT

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Glow Electric Company

927 HARRIET ST. CINCINNATI 3, OHIO PHONE MAIN 3024

N.I.S.P. NATIONAL INDUSTRIAL SERVICE ASSOCIATION

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New and used equipment recently released from service by a number of electric and gas utility companies

POWER PLANT EQUIPMENT
CONSTRUCTION EQUIPMENT
SUBSTATION EQUIPMENT
TRANSMISSION LINE MATERIALS

Send for new list . . . to

EBASCO SERVICES INCORPORATED
APPARATUS EXCHANGE
Two Rector St., New York 6, N. Y.

TRANSFORMERS FOR SALE

Rebuilt and guaranteed for one (1) year.

Qu.	KVA	Make	Type	Ph.	Cy.	Voltage
2	25	GE	HN	1	60	6900/230/460
3	25	GE	HN	1	60	2300/4160/115/230
3	25	West.	SK	1	60	2300/4160/115/230
3	25	GE	H-KH	1	60	11500/230/460
2	25	Kuhlman	OISC	1	60	2300/4600/115/230
1	37½	GE	HN	1	60	6900/115/230
3	37½	GE	HK	1	60	2400/4160/240/480
2	30	GE	HK	1	25	2300/230/460
3	50	West.	SK	1	60	4160/240/480
1	50	GE	HT	3	60	4800/240/480
1	50	Subway GE	HKW	1	60	2400/120/240
3	50	Kuhl.	OISC	1	60	11000/120/240/480
2	50	West.	SK	1	25	2200/230/460
1	75	West.	SK	1	60	2300/115/230
1	75	GE	HKF	1	25	2300/115/230
3	75	A.C.	OISC	1	60	33000/2400/4160
2	100	West.	SK	1	60	2400/4800/120/240
1	100	Furnace	OISC	1	60	440/60/80/110
1	100	West.	SK	1	60	2300/115/230
1	100	GE	HKR	1	60	12000/4800
3	125	West.	OD	1	25	440/50
1	150	GE	HKR	1	60	11500/480
3	150	West.	SL	1	60	11500/230/460
1	180	Pittsburgh	OISC	3	60	440/135/110
3	200	West.	S	1	60	2400/4160/120/240
3	200	West.	SK	1	60	6900/230/460
3	20L	GE	HVD	1	60	23000/2300/4600
3	667	GE	HDJP	1	60	2400/4160/230/460
3	667	GE	HDDP	1	60	4800/230/460
3	667	GE	HDDP	1	60	7200/230/460
3	667	GE	HDDP	1	60	12000/230/460
3	667	GE	HDDP	1	60	22000/2300/230/460
2	1100	West.	OISC	3	60	4160/440
2	1100	West.	OISC	3	60	4800/480
2	1500	West.	OISC	3	60	2400/4800/7200/13800/480
1	325	Furnace	OISC	1	60	4600/125
3	350	Amer*Auto	OISC	1	60	480/240/40/20

Large assortment of Current Transformers. Our stock is constantly changing, send us your requirements.

BUFFALO TRANSFORMER REBUILDING CO.
1500 NIAGARA STREET Tel. GRant 2715 **BUFFALO 13, NEW YORK**

MOTORS—M. G. SETS—TRANSFORMERS

ENGINEERED AND REBUILT BY EXPERTS IN OUR OWN PLANT

SYNCHRONOUS MOTORS

Qu.	H.P.	Make	P.F.	Volts	R.P.M.
1	6000	G.E.	100	2300	90
1	3000	Whse.	80	4800/2400	720
2	2100	G.E.	100	2300	360
2	1750	G.E.	100	2300	3600
1	750	G.E.	80	2300	450
1	600	G.E.	100	440	360
1	700	G.E.	80	2300	720
1	250	G.E.	100	2300	514
1	200	Whse.	80	440	1200
1	187	G.E.	80	440	720
1	150	G.E.	100	2200	900
1	150	G.E.	100	550	600
1	150	Whse.	80	220/440	450
2	135	G.E.	80	4000/2200	1200
3	125	El. Mchy.	100	4800/2400	900
1	125	G.E.	80	2200	900
2	100	Whse.	80	440	1800
1	100	Ideal	80	440	900
2	100	G.E.	80	440	600

With these we can supply—Manual, Semi on full magnetic reduced or full voltage control.

SQUIRREL CAGE MOTORS

3-Phase — 60 Cycle

Qu.	H.P.	Make	Type	Volts	R.P.M.
1	400	Cont.	NZ-806	2300	1200
2	400	G.E.	I-K	2200	v514
1	400	G.E.	KT-412	2200	450
1	300	Whse.	CS-890	2300	1780
1	200	Whse.	CS-873-C	2200	1200
1	200	Al.Ch.	ARY	440	600
1	125	Al.Ch.	AR	2200	1750
1	125	Al.Ch.	AR	2300	514
1	125	C.W.	126-Q	440	430
2	100	Whse.	CS-663-C	440	1750
1	100	Al.Ch.	AR	550	720
1	100	Whse.	CS-938	2200	514
1	100	F.M.	H-241	440	450
2	75	Al.Ch.	AR	2200	1705
1	78	G.E.	I-K	440	600
1	75	Al.Ch.	AR	2200	720

Special—1 (new) G.E. Vertical KF-574, 2200-Volt 580 R.P.M., enclosed, hollow shaft.

MOTOR GENERATOR SETS

Qu.	KW	Make	RPM	Volts DC	Volts AC
1(3-U)	2400	Whse.	720	600	2400/4800
2	1500	G.E.	600	600	4150/2300
3	1000	Whse	514	600	11000/6600
4	1000	G.E.	514	600	11000/6600
1	1000	G.E.	514	600	2300
2	500	C.W.	720	575	2300/440
1	400	C.W.	1200	125/250	440/2300
2	250	Whse.	1200	125/250	2300
1	200	Ridgway	900	275	2300
2	200	Whse.	1200	125/250	440
1	155	G.E.	720	250	2300/440
2	150	Whse.	1200	250	2300
1	100	Al. Ch.	1200	125/250	4000/2300
1	100	Delco	1200	125/250	440/220
1	100	Ridgway	1200	275	4000/2300
1	100	C.W.	1200	125	440/220
1	85	C.W.	1200	250	440/220
1	75	Al. Ch.	900	250	2300
1	75	Whse.	900	75	2300
1	25	Ideal	1750	125	220
1	25	Al. Ch.	1200	250	440/220

We can furnish any of these sets with exciters and VARIABLE VOLTAGE CONTROL engineered and rebuilt to your requirements.

Motor Generator Sets of modern design, complete with control—still on their original foundations—available for immediate shipment.
(3)—G. E. 1500-KW, 250-VDC, 514 R.P.M., cpd., interpole, pole face windings, 2100-HP syn. motors, .8-PF, 13,200-V, 3-p, 60-cy. will reconnect to 6600-V. or 4160-V.

TRANSFORMERS

Qu.	KVA	Make	Type	Phase	Voltage
3	833	Whse	OISC	1	66000/59400-2300/4160
1	2750	G.E.	H	3	13,800-2400/4160Y
3	250	Packard	A	1	13,200-2200
3	150	Packard	A	1	2300-230/460
3	100	G.E.	H	1	33,000-2300
3	25	G.E.	H	1	2400-120/240
40(new)	3	Al.Ch	OISC	1	2400-120/240

SLIP RING MOTORS—CONSTANT DUTY

3-Phase — 60 cycle

Qu.	H.P.	Make	Type	Volts	R.P.M.
1	1800	G.E.	MT 498	2300	357
1	1200	G.E.	MT 26	2200	277
2	1000	Al.Ch	ANY	2200	235
1	800	G.E.	MT	2200	440
1	700	Whse	CW	2300	720
1	600	G.E.	MT 20	2300	360
1	500	Al.Ch.	ANY	2200	514
2	500	G.E.	I-16-M	2300	450
1	400	G.E.	MT 412	2200	440
1	250	Whse.	CW 937	440	1200
1	250	Al.Ch.	ANY	440	720
1	250	G.E.	MT 414	2200	300
1	125	Whse	CW 870	2200	900
1	100	Whse.	CW 766	440	1200
1	100	F.M.	H 20 C	440	900
2	100	G.E.	I-15A-M	2300	514

DIRECT CURRENT MOTORS

Qu.	H.P.	Make	Type	R.P.M.
1***	3000	Whse.	Encl. (Rev.)	600
1***	2400	Whse.	Encl. (Rev.)	600
4***	1500	Whse.	Encl. (Rev.)	600
4***	1200	Whse.	Encl. (Rev.)	600
4***	800	Whse.	Encl. (Rev.)	600
1	350	G.E.	CD-169-A	1150
1	200/250	El. Dy.	No. 22	400/1200
1	250	G.E.	MPC	325/975
1***	200	G.E.	MPC	500/1200
1	200	Whse.	Mill	300/1200
1	180	G.E	MPC	400
1***	125	Whse.	SK-190	600
2	125	Whse.	SK-184	575/850
1	90/160	G.E.	MPC	625/1125
1	100	Rel.	1050T	400/1200

All above 230-VDC except where marked***!
***—Pedestal bearing mill design 525/600-VDC.
Rev.—designed for mill reversingservice.

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TURBO UNITS, Non-Condensing

1560 KVA GE 480 v. 150/200 lbs & 15 lbs. bp.
937 KVA GE 480/240 v. 150/200# & 0/15# bp
375 KVA Al. Chal. 240/480 v. 135/150# & 0/25# bp
125 KVA GE 240/480 v. 135/200# & 0/25# bp

BOILERS

2—812 HP Combustion 4 drum, 300#
3—45000# BW 275# Integral furnace F19. "1937"
2—30000# Combustion 2 drum, package type, 250# "1949"
1—309 HP Combustion 3 drum, 160# "1940"
1—300 HP Keeler CP, package, 300# "1948"
1—256 HP Combustion 150#, semi-portable, "1950" Steel encased; firetube
2—255 HP Combustion, 200# 3 drum. "1937"
1—125 HP Erie City, 200# self contained "1947"

DIESEL UNITS

1136 KVA (2) FM opposed piston, 720 RPM
1000 KVA Elliott-DeLaVergne 200 RPM
483 KVA (2) GE-Winton (GM) 360 RPM
375 KVA E.M.-Buckeye, 8 cyl. 600 RPM
300 KVA F.M. 277 RPM
220 KVA (2) Wghse.-Buckeye 7 cyl. 400 RPM
187 KVA E.M.-Buckeye 5 cyl. 514 RPM
150 KVA FM Model 32-257 RPM
100 KVA General Motors 1200 RPM
50 KVA GE-Caterpillar 900 RPM
37 KVA General Motors 1200 RPM

STEAM ENGINE UNITS, A.C.

375 KVA (2) Wghse—Skinner Uniflow
187 KVA Wghse.-Ames Uniflow (vertical)
150 KVA GE-Skinner Uniflow
75 KVA GE-Ames Uniflow

POWER PLANT EQUIPMENT CO., INC. 39 Cortlandt St. New York, N. Y.

POWER PLANT EQUIPMENT

SPECIAL OFFERINGS

TURBO-GENERATORS

1—20,000 KW, 200# 13,230 V.
1—10,000 KW 200# 13,800 V.
1— 5,000 KW 275# 11,500 V.
1— 4,000 KW 490# 2300 V.
1— 3,000 KW 475# 13,200 V. Ext/170# Non Cond.
1— 2,000 KW 175# 550 V. Cd.
1— 1,500 KW 150# 2300 V. Cd.
1— 1,500 KW 175# 550 V. Ext.
1— 1,250 KW 250# 2400 V. Ext.
1— 1,000 KW 200# 4160 V. N.C. NEW 1949.
2— 750 KW 150# 251 V. D.C.
1— 500 KW 200# 4160 V. N.C.
1— 300 KW 125# 250 V. D.C.
2— 120 KW 180# 240 V. N.C.

DIESEL GENERATORS

1—1000 KVA 2400 volts
3— 500 KW 480 volts
1— 400 KW 480 volts
1— 300 KW 2400 volts
2— 75 KW 240/480 V.

BOILERS

2—50,000# 275# (1949)
3—15,000# 275# (1945)
1—400 HP Sec. Hd. 225#
2—250 HP 200# (1940)
1—84" HRT 150# (1942)

WATER WHEEL GEN.

1—180 KW 20 F.H. 550 V.

Write or wire for additional data and prints.

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THE BUYERS MUST BE SATISFIED—ALWAYS

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1—Carbondale 10x10 Vert. twin cylinder Ammonia Compressor, 82 ton, 75 HP motor.
1—Taber Fermentation Gas Collector with 8 storage tanks 50 cu. ft., ASME 245# WP.
5—Niagara Spray Cooler and Fan Cooler Units.
1—Rotary Pump 5", with 40 HP motor, 1000 GPM—86' Hd.
22 Welded Steel Storage Tanks (closed) 5500 gal., 10,500 gal., 11,300 gal. and 12,700 gal.
22 Welded Steel Tanks, 16'10" L x 7'7" W x 8'9" deep, open top, flat bottom.

FOR SALE FROM PHILA. STOCK

2—I-R Motorblowers, type FS-538; cap. 4000 CFM @ 3# Pr.
1—Byron Jackson Bronze Deep Well Turbine Pump with 20 HP motor. 150 GPM.
1—I-R #5-ALV Bronze Centrifugal Pump with 40 HP motor. 850 GPM—140'.
1—I-R #1½-RVH Bronze Centrifugal Motor-pump with 20 HP motor. 200 GPM—200'.

PERRY EQUIPMENT CORP.

1422 N. 6th St. PHILA. 22, PA.

450 KVA—3-60-13200-115/230 V. substation.
1000 KVA—3-60-13800-240/460 V. substation.
700 & 450 HP—180 rpm—4160-3-60 UNUSED Syn motors.
3—600 A.—15 kv GE metalclad Swgr. units.
3—500 KVA—3-60-13800-240/480 V. Transformers.
1—37½ KVA 240/480 V.—3-60 Caterpillar Diesel set.

H. BLANE JOHNSON & ASSOCIATES
53 W. JACKSON BLVD., CHICAGO 4, ILL.

JLHCo

This Hemphill Seal tells you the

SAFE WAY TO BUY EQUIPMENT GUARANTEED GOOD BECAUSE BUILT & TESTED BY HEMPHILL ELECTRICAL ENGINEERS

TRANSFORMERS—60 Cycle

Qu.	KVA	Make	Type	Ph	Voltages
1	1500	G.E.	Pyranol	3	4150x2400
1	1000	G.E.	Auto	3	4150x2400
2	750	G.E.	HT	3	4150x120/240
1	500	Kuhl.	OISC	1	4150x2400
2	400	Pitts.	OISC	1	4800/4150/2400 x240/480
3	333	Whse	OISC	1	2400x575
1	333	G.E.	H	1	13200x220 440
2	300	G.E.	H	1	13200x440
1	200	G.E.	H	1	13200x440
3	200	G.E.	H	1	13200x440
2	200	A.C.	CBS	1	480x120/240
3	200	Mol.	C	1	2300x220/440
1	200	G.E.	HT	3	2400x240
2	150	Pitts.	ODSC	1	240x120/240
3	150	G.E.	H	1	2400x120/240
3	100	G.E.	H	3	13750x125/216Y
3	50	G.E.	H	1	4800x120/240
3	25	G.E.	H	1	575x115/230
3	25	Nlag.	OISC	1	2400x480
1	25	G.E.	H	1	440x110/220

MOTOR GENERATOR SETS

Qu.	KW	Make	Speed	DC	AC
1	1000	G.E.	514	600	2300/4150 Syn
1	1000	Whse.	720	600	2300/4150 Syn.
1	1000	Whse.	720	275	2300/4150 Syn.
1	150	3 Unit G.E.	1200	125/250	2300 Syn.
1	150	Whse.	600	125	4150 Syn.
1	125	C.W.	1200	125	2300 S.C.
1	100	G.E.	900	250	2300 Syn.
3	60	G.E.	1200	125	208 Syn.

SYNCHRONOUS MOTORS

Qu.	H.P.	Make	Speed	Type	Volts
1	300	El. Mach.	720	TEFC	2200
3	200	Whse.	720		4150
1	175	G.E.	720	ATI	2300
1	150	G.E.	720	ATI	2300
1	150	G.E.	1800	TS	220
1	150	Whse.	900	181G	220
1	150	A.C.	360		440
1	125	El. Mach.	900		4800
1	100	G.E.	900		2200

SLIP RING MOTORS

Qu.	H.P.	Make	Speed	Type	Volts
1	400	Whse.	450	CW	550
1	250	Whse.	600	CW	440
1	200	Whse.	600	CW	440
1	200	G.E.	600	MT	440
3	150	A.C.	1800	AY RW	2300
1	100	G.E.	1800	IM	220
1	100	G.E.	600	IM	440
1	75	G.E.	600	IM	440
1	60	G.E.	1800	MT	220
1	60	G.E.	900	MT	440

SPECIAL M.G., A.C. WELDER

1—176 KVA Whse., 220 V. 57 PF, 1200 RPM, 1 ph., with 75 HP Slip Ring, 440 V, type CW, Exc. & Control w. flywheel.

SPECIAL WELDING

1—150 KVA GE, type KWC, 1 ph., 550 V, sec. 12.22/6.05 V, Thryatron Spot and Seam, Control CR 7503

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FOR SALE

SUPERIOR HEAVY DUTY DIESEL

510 HP at 360 RPM—5 cylinder—14½x18—type ZDSB—non-reversing—vertical—4 cycle—cold starting—mechanical injection. Engine totally enclosed. For heavy duty pumping, dredge service, power generation, textile and saw mills, mining, etc. EXCELLENT CONDITION. IMMEDIATE DELIVERY.

30 KW GM 3-71 DIESEL GENERATOR SET

GM 2 cylinder 4½x5 diesel—radiator cooled—electric starting. Delco 3/60/440 generator—with switchgear. Skid mounted—portable.

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313 E. Baltimore Street
Baltimore 2, Md.
Curtis 5050

3—400 KVA GE Transformers—Rebuilt 1952
1—125 Ton 54 'Span Crane with 5 motors
1—120 KW 240 V. Diesel Electric Set
1—50-40-20 HP Dutton Package Boilers
1—300-250-200-100 HP Slip Rg. Motors
1—505'x18" Belt Conveying Equipment
3—1000 KW AC Generators for Diesels

H. & P., 6719 Etzel, St. Louis 14, Mo.

Anything in **ELECTRICAL EQUIPMENT**

PARTIAL STOCK LIST — SEND US YOUR INQUIRIES

MOTOR GENERATOR SETS

150 KW W.H., Type Sk, 250 V, D.C., 2300/.3/60—1200 RPM, A.C. Sync.

150 KW Al.Ch., 230 V, D.C. 2300/3/60—1200 RPM, A.C. Sync.

ROTARY CONVERTERS

2—1000 KW, G.E., Type HCC, 600 V, D.C. with transformers, 900 RPM, 6 Phase, compound interpole.

SYNCHRONOUS MOTORS and CONDENSORS

2—W.H., 1500 KVA, 4600/2300/3/60—900 RPM, 2 Pedestal Bearing

1—G.E., 1500 KVA, 4600/2300/3/60—900 RPM, 2 Pedestal Bearing

1—400 HP W.H., Form IS, P.F. .8—P.B. 900 RPM

VENN-SEVERIN DIESELS, 7 YEARS OLD, BARGAIN

KW	HP	RPM	CYL.	ENG. NO.	VOLTS	PH.	CYC.
2	215	300	3	5312	240/480	3	60
2	200	300	4	5800	240/480	3	60

SLIP-RING MOTORS

1—Al. Ch. 400 HP, 505 RPM, 2300 V, Serial #110,844

1—Al. Ch. 400 HP, 1800 RPM, 2300 V, Serial #9410H146D

MOTORS, GEAR HEAD, A.C.

7½ HP W.H. TEFC, 3/60/220/440-580 RPM—RB

20 HP Link Belt, Size DM70, 3/60/220/440-74 RPM—RB

20 HP W.H. TEFC, 3/60/220/440-194 RPM—RB

40 HP G.E., TEFC, 3/60/220/440-561 RPM—RB

GEAR REDUCERS

3—Falk, Type 11HCP, 20 HP Ratio 10:1

BUCKEYE *Trading Corporation*

LARGEST STOCK IN MIDWEST

1015 to 1021 PAPIN STREET CHESTNUT 2110 ST. LOUIS 2, MISSOURI

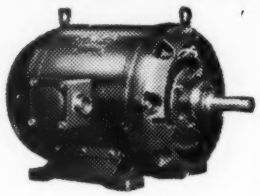
NEW MOTORS! • STOCK SHIPMENT.

ALL BALLBEARING

General Electric, Louis Allis, Reliance, Westinghouse.

NEMA FRAME

Discounts from 60% to 65% Off on items listed below.



TEFC & EXPLOSION-PROOF

* I-D Label—** 2-G Label

3/60/220-440

Quan.	HP	Speed	Make	Frame
1	75	3600	G.E.	504
2	60**	3600	Rel.	445
2	60**	3600	G.E.	445
1	60	3600	Wag.	445
1	50**	3600	G.E.	444
2	40**	3600	Rel.	405
1	40**	3600	G.E.	405
1	30*	3600	L.A.	405
2	30**	3600	G.E.	404
5	20**	3600	L.A.	364
1	15*	1800	L.A.	326
1	15*	1800	L.A.	364
1	10*	3600	L.A.	284
5	10**	3600	L.A.	284
2	10*	1800	L.A.	324
5	5**	3600	L.A.	225
3	5*	1800	L.A.	254
1	5*	900	L.A.	324
1	2*	1800	L.A.	225
1	2*	1800	L.A.	224
1	2*	1800	L.A.	225
1	1½*	1200	L.A.	224
10	1*	3600	L.A.	167
1	½*	1800	G.E.	63A

1/60/115-230

6	3*	1800	L.A.	254
1	1½*	1800	L.A.	225
6	1*	1800	L.A.	224

OPEN DRIP-PROOF
3/60/220-440

Quan.	HP	Speed	Make	Frame
1	100	3600	G.E.	445S
13	40	3600	Rel.	404S
1	30	3600	G.E.	365
1	25	3600	G.E.	364S
2	15	3600	L.A.	324
1	10	3600	L.A.	284
1	10	1800	L.A.	324
1	7½	1800	L.A.	284
1	7½	1800	L.A.	284
7	7½	900	L.A.	326
1	5	3600	L.A.	254
1	5	1800	L.A.	254
2	5	1200	L.A.	284
2	5	900	L.A.	324
7	3	1800	Std.D.	225
4	3	1800	L.A.	225
2	3	1200	L.A.	254
1	3	1800	L.A.	224
10	2	1200	L.A.	225
1	1½	1800	L.A.	204
2	1½	1200	G.E.	224
2	1½	1200	L.A.	224
7	1	3600	Rel.	203
2	1	1200	L.A.	204

2/60/220-440

2	15	3600	L.A.	324
1	10	3600	L.A.	284
1	10	1800	L.A.	326
1	7½	900	L.A.	326
2	5	1200	L.A.	284
3	1½	1200	L.A.	224
4	1	3600	L.A.	163
2	1	1800	L.A.	203

OPEN DRIP-PROOF
1/60/115-230

Quan.	HP	Speed	Make	Frame
26	1	1800	L.A.	204
8	1	1800	Std. D.	203

3/60/550

1	100	3600	G.E.	445S
3	40	3600	Rel.	404S
1	25	3600	G.E.	364S

25 CYCLE, TEFC & EXPLOSION-PROOF (2-G Label)

1	40	1500	G.E.	504U
1	30	1500	Rel.	445
1	30	1500	G.E.	445
1	25	1500	Rel.	405
1	20	1500	G.E.	405
1	15	1500	G.E.	404
2	10	1500	L.A.	364
1	5	1500	L.A.	284
2	5	1500	L.A.	284

230 VOLT D.C. MOTORS

1	10	1150	Whse.	63
3	7½	850	L.A.	326
1	7½	1150	G.E.	66
4	7½	1150	E. Dyn.	324
1	5	1750	Whse.	254
3	5	1750	Rel.	184T
1	3/5	575/1725	L.A.	326
5	3	3500	Rel.	224
4	3	1750	Whse.	225
1	3	1150	L.A.	254
2	3	1150	E. Dyn.	254
2	3	900	Cent.	284

Quan.	HP	Speed	Make	Frame
2	2	3600	G.E.	204
5	2	3500	Rel.	204
1	2	1750	L.A.	225
2	2	1150	L.A.	225
1	2	1150	Rel.	225
2	2	1140	L.A.	225
10	1½	3500	Rel.	203
6	1½	1150	E. Dyn.	224
1	1½	1150	Rel.	224
10	1	3500	Rel.	203
1	1	1750	L.A.	203
2	1	1750	Whse.	204
1	1	1750	Whse.	204
1	1	1750	Whse.	204
5	1	1150	E. Dyn.	204
3	1	900	Cent.	224

115 VOLT D.C. MOTORS

1	10	1400	Star	17L
1	4	1140	L.A.	254
1	3	1750	L.A.	225
1	3	1150	Whse.	254
2	2	3500	G.E.	204
2	2	1750	L.A.	225Z
1	2	1750	Whse.	225
2	2	1120	Whse.	225
3	1½	3600	Rel.	203
2	1½	1120	Whse.	224
2	1	1750	Whse.	204

3/60/220 GEARMOTORS

3—5/3.3/2.3/1.66 HP. 55/36/27/18 RPM. Whse. Frame FD324, Parallel shaft output.

35	½	13.5	G.E.	63A

Parallel shaft—220/440 V

10,000 OTHER MOTORS IN STOCK—FHP THRU 1000 HP, NEW AND REBUILT.

BENSON-WILIMZIG, INC.

1708 North 8th Street — GArfield 4290 — St. Louis 6, Missouri

PHONE — WIRE — OR WRITE

COMPLETE POWER PLANTS

STEAM — ELECTRIC — HYDRO — DIESEL

"Export Orders Carefully Executed"

FOR IMMEDIATE DELIVERY

TURBO-GENERATORS—Condensing—500 to 20,000 KW; some extraction type, pressures 200 to 450#. *ON WHAT SIZE SHALL WE QUOTE?*

TURBO-GENERATORS—Non-condensing—300 to 3000 KW. 150# to 450#. some extraction with high back pressure. *WHAT SIZE INTERESTS YOU?*

STEAM GENERATORS—30000# to 100000# per hr. 150# to 450#.

BOILERS—Water Tube, Stirling & Straight Tube types 200 to 450#.

Special 2—500 & 1-770 H.P. B&W Co. Stirling Boilers 200#—excellent condition.

2—2000 H.P. B&W Sectional Header Boilers.

BOILERS—Fire Tube, 100 to 300 HP. 100 to 250#. *WHAT BOILERS?*

TRANSFORMERS Quick Delivery, Various Sizes Rebuilt like NEW—Guaranteed. Motor-Generators, Rotaries, Frequency Changers, Large Motors & Diesel Generators.

Send us your INQUIRIES for ALL POWER MACHINERY

CHARLES B. REARICK — 30 CHURCH ST. — NEW YORK 7, N. Y.

SURPLUS BOILERS [A-1 Condition]

100,000# hr. Sterling 450#, 125 SH
87,000# hr. Maximum Bent tube, 350#
60,000# hr. Bent tube, 275#. Water Walls
55,000 to 75,000#, Sect. Header, 450# SH
50,000# hr. Cross Drum, 400#, 150 SH

And others 200-250# pressure

TURBO GENERATOR UNITS 200-450#
Condensing, Non. Cond., Extraction

1500 KW DIESEL PLANT—Low Price
Transformers

STEPHEN A. DOUGLASS CO.
630 Ft. Washington Ave., New York 33, N.Y.

ELECTRICAL EQUIPMENT

REBUILT N.I.S.A. STANDARDS

AC Motors — 3 phase 60 cycle

HP	Speed	Make	Wdg.	Type & Disc.
200	1800	GE	SC	K6333S TEFC
150	1800	GE	SR	M-6328 TEFC
150	720	Allis-Chal.	SR	AR-Hoist
150	720	West.	SC	CS
125	3600	Elliott	SC 2200 V.	9NS02
125	600	GE	Syn.	TS-DC Exciter
100	1800	GE	SR	IM
100	725	Allis-Chal.	SR (25 cy.)	ARY-3 Brg.
100	900	GE	Syn. 2200 V.	TS-DC Exciter
100(2)	1200	GE	SC	I-K
75	1200	Wagner	SC	24-W
75	900	AC	SC	AR-BB
75	600	GE	SR	IM
75	600	GE	SC 2200 V.	KT-558
60	1200	GE	SC	I-K
60(2)	3600	GE & W	SC	K&CS 4448B
60(3)	1200	Allis-Chal.	SR	ARY-505 BB
60	900	AC	SC 2200 V.	ARZ-TEFC
50	1800	GE	SC	IK
50	1800	FM	SR	HV-BB
50	1200	GE	SR	MT-336
50	900	GE	SC	IK
50	720	CW	SC	SC
50	600	CW	SR	SR
40	3600	GE	SC	K-405s Exp. Pr.
40	1800	GE	SC	KT
40(2)	1200	Rel.&West.	SC	Fr 445-BB
40(2)	1200	FM	SR	HV-BB
40(2)	1200	AC&Rel.	SC	TEFC-BB
40	900	West.	SR	CW
30(3)	1800	AC	SC	ARZ-TEFC
30	1200	AC	SC	ARZ-TEFC
30	1200	CW	SC	SC-BB
25	1200	Howell	SC	KBB-405 TEFC

SPECIALS

3—150 KVA Transformers GE Type H Form KD 1/60 33000 V. pri-2300/6900/11950Y. 2—150 KW West. M-G Sets 275 V. DC 3/60/2300 AC. 2—56RZ Falk Motoreducers 125 RPM 50 HP Class II. Hundreds other motors and electrical Items in stock. Large stock new motors to 150 hp & Gearheads to 30 hp at rated discount—Freight allowed. SEND US YOUR INQUIRIES.

NATIONAL ELECTRIC SERVICE CO.

735 So. 4th St., St. Louis 2, Mo. — Phone — Chestnut 4603

Immediate Delivery in All Types of

BOILERS

Bought • Sold • Rented

ERIE CITY ECONOMICS

125 Lbs.—150 H.P.—1933-1938
150 Lbs.—125 H.P.—1947
Fire Box Type—165 H.P.—125 Lbs.—1941
Package Type—10-15-50-60 H.P.
Heating Boilers—5000-8000-12000 Ft.
8000 Gal. Cement Lined Hot Water Heater
Oil Burner—150 G.P.H. #6 Oil, Rotary, Equal New.

BOILER & EQUIPMENT CO.

743 Bedford Ave. Brooklyn 5, N. Y.
ULster 5-3588

"Industry's Friend"

TAW gives satisfaction

Tampa Armature Works, Inc. products have satisfied industry's needs for over 32 years. When you buy TAW products, satisfaction is guaranteed!

10,000 KVA TRANSFORMER
BANK OF 3-3333 1 Ph. 60 Cy.
66000 to 33000 & 13200 VOLTS

1800 KVA 3 Ph. TRANSFORMER
6600 to 440 VOLTS 60 Cy.
READY TO SHIP

TURBO GENERATORS—CONDENSING
In Stock

1— 625 KVA 3000 KW 3600 RPM Allis Chalmers 200 lbs. 100° SH. Will operate 375 lbs. 6150 TT without change. Generator 3/60/11500. Can be changed to 2400/4160. Complete auxiliaries. Can be operated for inspection. Checked by factory engineer in Sept. 1951—no repairs required.

1—1567 KVA 1250 kw 3600 RPM Allis-Chalmers 150 lbs. Will operate 200 lbs. 450° TT without change. Generator 3/60/2300. Complete auxiliaries.

1—1250 KVA 1000 kw 3600 RPM Westinghouse 185 lbs. 100° SH 3/60/2300. Completely reworked, generator has new winding. Complete auxiliaries.

1— 937 KVA 750 kw 3600 RPM Gen. Elec. 150 lbs. Generator 3/60/2300.

OUTDOOR OIL CIRCUIT BREAKERS

1— 600 A. 110 KV GE FKO136
1— 400 A. 73 KV West. G-1
3— 400 A. 37 KV GE FKO136
1— 400 A. 37 KV West. 0221
1—1200 A. 15 KV GE FHKO236
1— 600 A. 15 KV West. 0221
1— 600 A. 15 KV Condit 0-1

INDOOR OIL CIRCUIT BREAKERS

1—2000 A. 15 KV 500 MKVA West. CO-11
9—1200 A. 15 KV 500 MKVA West. CO-11
1—1200 A. 15 KV 150 MKVA West. B20B
1— 800 A. 15 KV 130 MKVA West. B20
12— 400 A. 15 KV 130 MKVA West. B20
1—2000 A. 4500 V. GE K-34

OTHER TRANSFORMERS
1 PH. 60 CY.

2—1000 KVA 13800/2300 V.
3— 200 KVA 33000-2300/4600 V.
7— 100 KVA 33000—2300/4600 V.
3— 75 KVA 2300—240/480 V.
40— 10 KVA 2400—120/240 V.

DIESEL GENERATOR
250 KW Superior YLO 350 HP
400 RPM 3/60/2200-440 or 220

OUTDOOR POTENTIAL TRANSFORMERS
13—33000/110 V. 200 V.—A GE E116
3—33000/110 V. Westinghouse

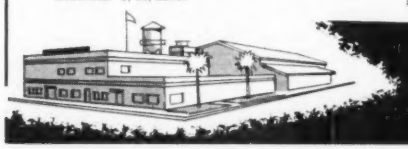
TURBO-GENERATORS—NON-CONDENSING
In Stock

1—1250 KVA 100 KW 3600 rpm General Electric 140 lbs. turbine with type ATB Form T 3/60/2300, 80 pf, Synchronous Generator.

1— 625 KVA 500 kw 3600 rpm General Electric 175 lbs. Single stage turbine with type ATB Form T 3/60/2300, 8 pt. Synchronous Generator.

1— 187½ KVA 150 kw Westinghouse geared 7200/900 rpm 150 lbs. 100° SH. Generator 3/60/240.

1—1250 KVA 100 kw Westinghouse geared 7200/900 rpm 150 lbs. 3/60/240.



TAMPA ARMATURE WORKS, Inc.
401 S. MORGAN ST. • TAMPA, FLORIDA • PHONE 2-1966

TURBINE GENERATOR SETS

1— 60 KW West. DC 120 Volt 1800 RPM
1—125 KVA GE AC/3/60/220 Volts/1200 RPM
1—250 KVA Elliott AC/3/60/220 Volts/1200 RPM
4—250 KVA GE AC 3/60/440 Volts/1200 RPM
4—500 KW West. DC/120-240 Volts 1200 RPM

DIESEL ENGINES & GENERATING SETS

20—G.M. Quads (Navy Re-processed)
2—Hamilton 1600 HP 720 w/Dir. Con. Blowers
3—GM 3-268A w/100 KW West. AC/440V/1200 (WILL SELL PARTS & GENERATORS SEPARATELY)
1—GM 8268A 500 HP Marine Engine w/Gear & Acces.
* 2—Hercules DWXD w/Heat Ex. & Twin Disc Clutch
* 1—Worth. DD8 w/480 KW GE 3/60/2300V/375
* 2—GM 8-268A w/200 KW West. 3/60/440V/1200

SYNCHRONOUS MOTORS

** 4— 75 HP Burke 3/60/220-440V/1800
** 2—125 HP El. Mach. 3/60/4800V/900
15—135 HP GE 3/60/4000 V/1200 TS963Z
* ** 1—200 HP El. Mach. 3/60/208V/1200
* 1—350 HP El. Mach. 3/60/208V/1200

AC & DC GENERATORS

* ** 75—3 KW GE 3/60/120-208V/1800 w/Panels
* ** 50—10 KW GE 3/60/120-208V/1800 w/Panels
* ** 8—25 KVA GE 3/60/440V/1800
** 2—56 KVA Star 3/60/120-208V/1200
1—75 KVA El. Mach. 3/60/440V/900
2—500 KVA El. Mach. 3/60/440V/900
** 4—25 KW West. DC 125V/1800 2 Brg.
4—500 KW West. DC 120-240V/1200
*NEW—**BALL BEARING

ALBERT HELLER CO.
210 Snediker Ave., B'klyn 7, N.Y. HYacinth 5-0800

SLIP RING MOTORS
3 Phase, 60 Cycle

Qn.	HP	Make	Speed	Type	Voltage
4	3500	G.E.	120	IM	2300
1	500	G.E.	720	MT-412, 1 Bear.	2200
1	350	G.E.	300	MT424	2300
1	250	G.E.	660/254	BTS-12	2200
1	200	Ideal	1200	Vert.	4000
1	200	G.E.	600	IM	220/440
1	200	Whse.	600	C.W.	220
1	200	G.E.	400	IM	440
1	150	Whse.	1200	HF	2200/4000
1	150	Whse.	900	CI	440
1	150	Whse.	720	C.W.	440
2	100	A-C	450	ANY	440
1	75	G.E.	900	MT	440
1	75	G.E.	720	IM	220
1	75	A-C	720	3-Bear.	220
1	70	Eng. El.	1200	DP BB	440
1	60	C-W	1800	SR-Vert.	220
1	50	G.E.	1200	IM	220
1	50	G.E.	900	MT	220/440
1	50	A-C	900		550
1	40	Whse.	900	C-W	220/440
1	30	G.E.	900	MT	220
1	30	G.E.	900	MT	2200

DIRECT CURRENT EQUIPMENT

Size	Make	Speed	Type	Voltage
700 KW	G.E.	720	MCF, 1 Bear.	550
325 KW	G.E.	500	MPC 3 Bear.	250
250 KW	G.E.	600	DMC 3 Bear.	250
150 HP	West. El.	1635	RC	230
150 HP	Diehl	250/400	K-15-10-3 Bear.	230
100 KW	G.E.	675	DLC	250
100 HP	Reliance	500	Open-SB	230
65 KW	Whse.	1175	SK-DP-BB	120
40 KW	Reliance	1150	DP BB	250
20 KW	Whse.	825	SK	230
25 HP(2)	Imperial	725	D	230
20 HP	Whse.	1150	SK	230

SQUIRREL CAGE MOTORS
3 Phase, 60 Cycle

Qn.	HP	Make	Speed	Type	Voltage
1	200	A-C	900	ART Hi Torque	440
1	200	G.E.	600	IK	220/440
1	100	Wagner	1200	TEFC CI	220/440
4	100	El. Prod.	900	BB	2200
1	75	Whse.	600	CCL	220
1	75	E-M	514	IC	440
1	60	G.E.	1800	K	220/440
1	60	A-C	1200	AR	220/440
1	60	A-C	900	ARV Vert	440
1	60	G.E.	720	IK	440
1	50	A-C	900	open	220
1	50	G.E.	1800	KT	440
1	50	Master	1800	CFU Vert.	220/440
1	50	El. Dyn.	1800	KNX TEFC	220/440
1	50	El. Dyn.	1800	Open BB	220/440
1	50	G.E.	1800	K	220/440
1	40	U.S.	1800	SA	440
2	40	A-C	1200	AR	220/440
1	40	A-C	1200	TEFC I-FRF	220/440
1	40	F-M	900	Open BB	220
1	40	G.E.	720	KT	440

SYNCHRONOUS MOTORS
3 Phase, 60 Cycle

1	220	G.E.	720	ATI	440
1	125	G.E.	720	ATI	440
1	115	E-M	600		220
1	50	Ideal	1200	SM	220

DYNAMOMETER

1—60 0HP, Eddy Current type, 1000/4000 RPM, type 2025A, 250 volt. Mfg. by Mid-West.

KECK ELECTRIC CORP.
Electric Motor & Engineering Service
201 N. Bluff Street **Joliet, Illinois**

1000 KW DIESEL GENERATOR SET

6 Cyl., 4 Cy., 300 RPM
Nelseco M.A.N. design
Bosch injection system
direct connected G.E.
Alternator, 3/60/2300 V.
Complete with Switchboard,
Starting Equipment & Spare Parts.

Overhauled. Ready to Ship

A. METTLER
904 Pacific St. Brooklyn 38, N. Y.
STerling 3-6515

SPECIAL TRANSFORMERS—YOUR SPECIFICATIONS

NEW TRANSFORMERS
OIL COOLED
AIR COOLED
PHASE CHANGERS

ARROW TRANSFORMER CO., INC.
1932 E. Westmoreland St., Philadelphia 34, Pa.
GArfield 5-0433

USED TRANSFORMERS
REWOUND
REBUILT
RECONDITIONED

AMERICAN 50 Years' Record Guarantees Satisfaction

- NEW AMERICAN AF—1 & 2 Stage—Electric Steam
- Rebuilts—Standard makes & sizes—Stationary or Portable
- Rental—Gas—Diesel—Electric—Steam
- Rebuild or Convert your Compressor

PORTABLES

80 CFM	Worthington (Gas) 2 PNEU
70 CFM	Smith (Gas) 2 PNEU
105 CFM	Worthington & Ingersoll
160 CFM	Worthington (Gas) 2 & 4 PNEU
210 CFM	Worthington (Gas & Diesel)
315 CFM	IR & Worthington (Gas & Diesel)
500 CFM	Worthington (Diesel) 4 PNEU
600 CFM	Worthington (Diesel) 4 PNEU

STATIONARY

CFM	PSI	SIZE	MANUFACTURER
44	150	5x5	Ingersoll ER-1
66	110	6x5	Penn-IR
69	125	6x6	Ingersoll ER-1
88	60	7x5	IR-Penn
93	100	7x6	American-IR
122	100	7x7	Worthington-IR
136	125	8x8	American-IR
166	135	8x9	IR-Worthington
211	100	9x9	Worthington HB
254	125	10x10	Chicago Pneu.
296	125	10½x11	American AF-1
311	40	12x8	CPT-Penn-IR
364	20	12x7	Worthington-IR
368	100	12x10	IR-CPT
379	40	12x9	Worthington HB
386	115	12x12	Ingersoll ER-1
460	125	12x13	American
503	60	14x10	IR-Sullivan
529	100	14x12	CPT-IR
628	100	14x13	Ingersoll
740	40	17x10	CPT-IR
780	55	17x12	Ingersoll ER-1
868	125	17/10x12	Chicago Pneu.
981	55	17x13	Worthington
1084	30	20x12	IR-CPT
1180	125	18/11x10	Chicago
1292	35	20x13	Worthington
1967	12	26x13	Worthington

America's No. 1
COMPRESSOR REBUILDER
Since 1902

We have a unit for your requirements from our stock of over 300 compressors & vacuum pumps.

AMERICAN AIR COMPRESSOR CORP.
Dell Ave. & 47th St., North Bergen, N.J. · Union 5-4848

ELECTRICAL CABLE

- For every Industrial and power application.
- Special constructions. Odd lengths.
- Large stocks on hand of high voltage, lead covered cables not ordinarily stocked by your regular suppliers.
- Cut to length. Reasonably priced.

UNIVERSAL WIRE AND CABLE CO.
2668 N. Clybourn Ave., Chicago 14, Ill.

BOILERS

300 H.P. Cleaver Brooks—complete oil fired package type boiler.
100 H.P. Erie City—complete stoker operated economic type boiler.
Excellent condition—Still in operation—
Immediate delivery 'Phone or write
COVERALL SERVICE & SUPPLY, INC.
551 Smith Street .. .. Buffalo 10, New York

FOR IMMEDIATE DELIVERY

TRANSFORMERS

Qu.	KVA	Make	Pri. V.	Sec. V.
3	1250	G.E.	23000	—2300/4000Y
3	1000	Wag.	13200/23000Y	— 220/440
3	1000	West.	11000	—2400
3	500	Mol.	44000	—33000
3	500	West.	13800	— 440
3	333	G.E.	2400/4160Y	— 480/240
2	250	West.	2300	— 460/230
3	200	G.E.	2300/4000Y	— 460/230
3	200	G.E.	33000	—2400/4160Y
2	150	G.E.	33000	—7200/12470Y
3	100	G.E.	44000	—2300/4000Y
9	100	G.E.	33000	—7200/12400Y
3	100	Al. Ch.	37000	—7200/12500Y
3	37½	G.E.	13800	— 230/115

TURBO GENERATING UNITS

1—3000 K.W., Gen. Elec. 3 Ph., 60 Cy., 2300/4000 Volt, 3600 RPM. 200# steam pressure. 7500 sq. ft. Worthington surface condenser.

1—100 K.W., Gen. Elec. Non-condensing, 3600 RPM. Turbo #27160, 3 Ph., 60 Cy., 600 Volts, (Can be reconnected to 480 volts full capacity. Can be reconnected to 240 volts at rating 100 KVA.) Dir. ctd. Exciter.

60 CYCLE MOTORS

1—250 H.P., Gen. Elec. Slip Ring, 40 deg. C. Form M. 3 Ph., 60 Cy., 2400 Volt, 2 bearing self contained, 1800 RPM with shaft for coupling.

1—50 H.P. Gen. Elec. Slip Ring, 40 deg. C., Type MT 356, 3 Ph., 60 Cy., 440 Volt, 600 RPM. Model 11677.

DIRECT CONNECTED ALTERNATING CURRENT UNIT

1—500 K.W. Westgh. 50 deg. 80% P.F., 3 Ph., 60 Cy., 2300 Volt, alternator dir. ctd. to 22 x 36" Nordberg Unaflow Non-condensing engine, 150 RPM, 175# steam pressure, 10# back pressure.

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SLIP RING MOTORS

220 or 440 volt, 60 cycle, 3 phase, slip ring Motors Rebuilt

H.P.	Make	Type	Speed	Description
400	G.E.	I-M	1200	S.B.
300	G.E.	I-M	1200	S.B.
200	G.E.	I-M	1200	S.B.
150	G.E.	I-M	1200	S.B.
150	G.E.	I-M	1800	S.B.
100	G.E.	MT-300	1800	S.B.
100	G.E.	I-M	900	S.B.
100	G.E.	I-M	720	S.B.
75	G.E.	MT-343	1200	S.B.
75	G.E.	I-M	900	S.B.
75	West.	CW	720	S.B.
75	G.E.	I-M	720	S.B.
60	G.E.	MT-333	1800	S.B.
40	G.E.	I-M	1800	S.B.

BRAND NEW SQUIRREL CAGE MOTORS

Totally enclosed, fan cooled, explosion proof, open 220 or 440 Volt, 60 Cycle, 3 Phase

H.P.	Make	Type	Speed	Description
150	G.E.	K-6326	3600	TEFCBB
150	G.E.	K-6326	1800	TEFCBB
125	G.E.	K-6326	1200	TEFCBB
100	West.	CS-607S	1800	TEFCBB
100	West.	CS-504	1800	B. B. open
75	West.	CS-504	3600	TEFCBBXP
75	A.C.	ARZ	1800	TEFCBBused
75	West.	CS-504	1800	TEFCBBXP
75	West.	CS-445	1800	B. B. open
75	F.M.	QS-445	1800	B. B. open
75	West.	CS-505	1200	TEFCBBXP
60	West.	K-594S	1800	TEFCBBXP
60	G.E.	QG-44	1800	TEFCBBXP
60	L.A.	QS-444	1800	B. B. open
60	F.M.	FB-404	3600	B. B. open
50	Master	K-445	1800	TEFCBBXP
50	G.E.	K-405	1800	TEFCBB
50	G.E.	CS-445	1200	S. B. drip
50	West.	K-505	900	S. B. open
50	G.E.	AR-444	3600	TEFCBBXP
40	A.C.	KF-365S	3600	TEFCBBXP
40	G.E.	CS-405	1800	B. B. Splash
40	West.	K-405	1800	TEFCBB
40	L.A.	404	1800	TEFCBBXP
40	G.E.	CS-504S	1800	B. B. open

REBUILT SQUIRREL CAGE MOTORS

220 or 440 Volt, 60 Cycle, 3 Phase, Open

H.P.	Make	Type	Speed	Description
200	Wagner	RP-2-26	1800	S. B.
200	Wagner		1200	S. B.
200	G.E.	K-564	900	B. B. new
150	West.	CS	1800	S. B.
150	G.E	I-K	1200	S. B.
150	G.E.	I-K	720	S. B.
100	West.	CS	1800	S. B.
100	G.E.	I-K	1800	S. B.
100	G.E.	I-K	1200	
100	G.E.	KT-347	1200	S. B.
100	West.	MS	1200	S. B.
100	West.	CS	900	S. B.
100	G.E.	I-K	720	S. B.
75	West.	CS	1800	S. B.
75	West.	CS	1200	S. B.
75	G.E.	I-K	900	
75	G.E.	KT-343	1200	S. B.
75	West.	CS-WL-607	1200	S. B. B.
75	G.E.	KT-552	900	S. B.
75	G.E.	KT-352	900	S. B.
75	G.E.	KT-346	720	S. B.
60	G.E.	KT-333	1800	S. B.
60	G.E.	I-K	1200	S. B.
60	West.	CS	1200	S. B.
60	G.E.	KT-346	900	S. B.
60	G.E.	I-K	900	S. B.
50	G.E.	I-K	1800	S. B.
50	Cr. Wh.	25R	1800	S. B.
50	G.E.	KT-327	1800	S. B.
50	G.E.	KT-336	1200	S. B.
50	West.	CS	1200	S. B.

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SLIP RING MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Speed
600	2200	Whse.	450
500	2200/4000	G.E.	900
450	440	Whse.	514
300	440	G.E. (hoist)	600
300	2200/440 (new)	Whse.	600
300	2200	G.E.	360
300	440	Whse.	3600
250	4000/2300	G.E.	450
250	440/220	Whse.	600
250	550/440	G.E.	1200
250	440	G.E.	600
200	440/220	Whse.	514
200	440	G.E.	450
188	4000/2300	G.E.	1800
150	2200/440	G.E.	600
150	550/220	G.E.	720
145	4000/2300	G.E.	1800
135	440/220	G.E. (hoist)	600
125	440/220	G.E.	900
125	550/440	G.E.	1200
125	2200	G.E.	600

SYNCHRONOUS MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Type	RPM
400	2200/440	G.E.	ATI	720
300	2300/400	G.E.	TS	720
300	2300/440	G.E.	TS	720
250	440/220	Whse.	HR	277
250	2200/440	G.E.	TS	1200
250	440/220	G.E.	ATI	600
240	2300/440	G E.	ATI	720
225	440/220	Whse.	HR	360
200	4150/2300	Whse.	G	1800
125	440/220	Whse.	HR	400
120	440/220	G.E.	ATI	900
110	440/220	G.E.	TS	257
100	440/220	G.E. (25 cy.)	TS	375
75	2200/440	Whse.	GE	600

CIRCUIT BREAKERS

3—3000 amp., GG E., 3 pole, 600 v
3—1600 amp., ITE, 3 pole, 600 v.

200 KW GE RECTIFIER UNIT

1—new—Ignitron type, 250/275 V. DC, 4000/2300 V. AC, 3 ph., complete all accessories including transformer, switch gear, etc.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
600	2200	G.E.	FT	3600
500	2200/4000	Elliot	SC	1800
350	2200	G.E.	KT	1200
350	2300	G.E.	KT	1200
300	2200	L. Allis	FS	1800
300	2200	G.E.	FT	3600
250	2200/440	G.E.	IK	720
225 (2)	2200/440	G.E.	KT	1200
200	2200/440	G.E.	K	1200
200	440	G.E.	IK	720
200	440	G.E.	IK	514
200	440/220	G.E.	KT	1800
200	2200/440	G E.	IK	600
150	2200	Al. Chal.	AR	1800
150	220	Whse.	CS	1200
150	440	Multi sp.	KT	1800/600
150	440/220	G.E.	IK	450
150	440/220	G.E.	KT	720
150	440/220	Howell	B. Brg.	1800
150	440/2200	G.E.	IK	514
150	2200/440	G.E.	KT	600
125	440/220	G.E.	KT (vert.)	1200
100	2200/440	G.E.	K	1200

A. C. GENERATORS

1—320 kva, 660 rpm, 2300/440/220 V., G.E.
1—275 kva, 1200 rpm, 440 V., G.E.
1—250 kva, 720 rpm, 2300/440 v., G.E.
1—225 kva, 600 rpm, 220/440 v., G.E.
1—200 kva, 720 rpm, 2200/440 V., G.E. (Ball brg.)
1—187 kva, 1200 rpm, 2200/440 V., Whse.

D. C. MOTORS

HP	Volts	Make	Type	Speed
250	230 (2 new)	Cr. Wh.	CMC	1800
150	230	G.E.	CD	1750
150	230	Whse.	SK	850
120	230	Whse.	SK	250/1000
100	230	El. Dyn.	30-3	475/1250
100	230	Cr. Wh.	CMC	625
90	230	G.E.	CD	1750
80	230	G.E.	BC	600
50	230	Rel.	T	400/1200

MOTOR GENERATOR SETS

KW	Make	Input V., AC	Motor Type	Output V., DC
250	Whse.	2200	Syn.	250
175	G.E.	220/440	Syn.	250
150	Whse.	440	sq. ca.	250
100	Al. Ch.	2200/440	sq. ca.	240/120
100	Whse.	440/220	sq. ca.	125
75	G.E.	2200/440	syn.	125
65	G.E.	2200/440	sq-ca.	250
65	G.E.	2200/440	sq. ca.	125
60	G.E.	440/220	sq. ca.	250/125
45	G.E.	440/220	sq. ca.	250
40	G.E.	440/220	sq. ca	250/125

TRANSFORMERS 60 CY.

3— 500 kva, Whse., 24000—2300 V.
1— 300 kva, Al. Chal. 4600/4160—240/120 V., 3 phase
3— 200 kva, G.E., 11000—2300 V.
3— 200 kva, G.E., 4150—480/240 V.
3— 150 kva, G.E. 23000—2300/4600 V.
3— 150 kva, Al. Chal., 2400—240/480 V.
3— 150 kva, Al. Chal., 2400-240/120 V.
3— 100 kva, Whse., 2400-240/480 V.
3— 100 kva, Whse., 2400—120/240 V.
3— 100 kva, G.E., 4150—120/240 V.
2— 100 kva, Whse., 2400—120/55 V.
3— 75 kva, Whse., 2400—240/480 V.
3— 75 kva, Moloney, 4150—240 V.
3— 50 kva, Whse., 440—220/110 V., dry
6— 50 kva., G.E., 2400—120/240 V.
11—50 kva, Whse., 2300-110/220 V., dry

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1—3000 KVA General Electric Synchronous Converter, Type HCC, 6 phase, 25 cycle, 250 RPM, 600 Volts DC with 1—3150 KVA General Electric Transformer, 3 phase, 25 cycle, 6600/13200-445 Volts with starting panel and all instruments.
1—1000 KVA General Electric Synchronous Converter, Type HCC, 6 phase, 25 cycle, 750 RPM 600 Volts DC with 1-1050 KVA General Electric Transformer, 3 phase, 25 cycle, 13200/445 volts with starting panel and instruments.
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3—200 H.P., B. & W. Cross Drum, sectional steel header, 160# w.p. watertube Boilers with superheat. 1944, 1940, 1939.

1—125 H.P. Erie City Economic, 125# pressure Complete with stack and trim. 1946.

1—125 H.P. Cleaver-Brooks, 125# w.p., No. 5 oil, 1946, pump, receiver and breeching.

1—30 H.P. Cleaver Brooks Package 125# w.p. No. 2 oil, 1950.

1—Babcock & Wilcox FF-15 Self-contained. 160 lbs. Complete Plant—16,000 lb. each.

Miscellaneous Scotch Marine Boilers, 75 to 150 H.P. available.

A Number of Self-Contained & Economic Units, 50-150 H.P., 100-200 Lbs. Pressure.

2—Detroit Roto-Spreader Stokers for 300 H.P. Boilers, nominal rating.

Combustion Engrg., Spreader Stoker complete with fan & Hogan Controls-Stoker. Designed for 600 H.P. boiler at 200% of rating, or 1200 H.P.

3—Elliot Surface Condensers, 1—900 sq. ft., 2—600 sq. ft. Located in New Jersey.

1—750 K.W. and 1—500 K.W. DC 240 V Generators dir. conn. to 2—Westinghouse non-cond. Turbines—3600 r.p.m. reduced to 900 r.p.m. on generators. Includes switchboards.

1—500 KW G.E. Turbine, 5 Stage with 625 KVA Alternator, 440 V., 600 sq. ft. Elliot super condenser.

1—300 K.W. Gen. Elec. Turbo-generator set. Completely rebuilt and rewound for 220/440 V. Includes switchboard and exciter. Presently boxed for export. Offered at an extremely low price.

WARNER J. SHERB, INC.

342 Madison Avenue, New York, N.Y.

Telephone MUrray Hill 2-9098

2—75 KW, GENERAL ELECTRIC 3 WIRE M.G. SETS

GENERATOR: 75 KW, type CD 1242, 250/125 volts, 1200 RPM, Compound Wound.

MOTOR: 125 HP, type K-5362, 3 phase, 60 cycles, 220/440 volts, 1200 RPM, Squirrel Cage.

Complete with DC Panels & AC (220 volts) Reduced Voltage Automatic Starters.

EMPIRE ELECTRIC CO., INC.

87 Jay St. BROOKLYN 1, N. Y.

COMPLETE STEAM PLANT

Consisting of 2—5000 KVA 2300/3/60/3600 RPM steam turbine generator sets. 150 pounds 200 degree F. superheat condensing. Very complete accessories. Practically unused, good as new. Immediate Delivery.

SOUL CLINIC INC. CALGARY, CANADA

POWER EQUIPMENT

TURBINE UNITS

1—5000 KVA G.E. 3/60/2300/4000 V. 3600 RPM STRAIGHT CONDENSING nozzled for 450 psig 750° TT. Surface condenser.

1—3750 KVA G.E. 3/60/2300/4000 V. 3600 RPM STRAIGHT CONDENSING nozzled for 200 psig 550° TT. Suface Condenser.

1—3750 KVA West. 3/60/2300/4000 V. 3600 RPM STRAIGHT CONDENSING nozzled for 375 psig 575° TT, 11.75# water rate surface condenser.

1—1250 KVA Al.Ch. 3/60/480 V. 3600 RPM. Terry EXTRACTION turbine nozzled for 250 psig 550° TT. 40,000# extr. 25 psig. surf. cond.

BOILERS

1—90,000# Springfield sectional header cross drum 400# WP 750° TT new stoker fired.

1—50,000# Edgemoor bent tube 255# WP 490° TT Coxe chain grate stoker and economizer. New 1939.

2—502 HP nominal Heine water leg type 200# WP 480° TT Coxe chain grate stokers. New 1929.

DIESEL ENGINE UNITS

1—2800 HP Nordberg 6900 V. 60 cy.

1—2000 HP Fairbanks Morse 6900 V. 60 cy.

1—1600 HP Fair. Morse 2300/4150 V. 60 cy.

1— 250 HP Buckeye 240 V. 60 cy.

MOTOR GENERATOR SETS—60 CY.

QU.	KW	MFR.	V.—DC	A.C.	RPM
1	3000	G. E.	250	13200	514
1	1500	G. E.	600	4150	600
2	1000	West.	660	4150	900
1	200	West.	275	2200	900
2	200	G. E.	250	4150	1200
2	150	G. E.	250	2300	1200
1	75	Ridgway	125	220	1200

SYNCHRONOUS MOTORS

QU.	HP	MFR.	VOLTAGE	RPM
1	3000	G. E.	6600	360
2	700	West.	2300	200
1	600	G. E.	2300	240
1	300	G. E.	2300	600
1	300	West.	2300	900
4	125	G.E.	2300	720

FREQUENCY CHANGERS

QU.	KVA	MFR.	CYCLES	RPM
1	12500	G.E.	25/60	300
2	6875	West.	25/62½	375
1	3750	G.E.	25/60	300
1	3125	G.E.	25/60	300
1	2500	G.E.	25/62½	750
1	1875	A.C.	60/25	300

OIL CIRCUIT BREAKERS—Outdoor

2— 400 A. 37 KV G.E. FHKO-136-350
1— 400 A. 37 KV G.E. FHKO-236-500
4— 600 A. 15 KV G.E. FHKO-139-750
1—1200 A. 15 KV G.E. FKO-139-350

TRANSFORMERS

4—	3333 KVA West.	69300/66000—33000
6—	2000 KVA G.E.	66000/114000—2400
4—	500 KVA West.	69000—6900
3—	300 KVA G.E.	66000/33000—2300, 3 ph.
3—	200 KVA A.C.	45000—2400/7200
3—	150 KVA Mol.	44000—2400/7200
1—	75 KVA West.	44000—7200/12470 Y
4—	5000 KVA G.E.	40935/70900 Y—14500
2—	5000 KVA West.	33000—26400, 3 ph.
4—	200 KVA A.C.	34500—6900/11950 Y
3—	150 KVA Wag.	33000—7200/12470 Y
3—	100 KVA West.	33000—240/480 NEW
3—	75 KVA Wag.	33000—7200/12470 Y
6—	2125 KVA G.E.	26400/13200—2300
4—	1500 KVA A.C.	25400/44000—6900/13800
4—	450 KVA A.C.	25410/44000—13280/23000
3—	1250 KVA G.E.	23000—2300/4000
3—	100 KVA G.E.	22000—7200/12470 Y
1—	450 KVA Penn.	13200—2400, 3 ph.
3—	200 KVA G.E.	13800—2300
3—	250 KVA Pitts.	7200—220/440
3—	100 KVA G.E.	7200—240/480
4—	150 KVA Wag.	6900—2300
4—	100 KVA G.E.	6900/11900—2400
3—	37½ KVA G.E.	6900—230/460
3—	1500 KVA A.C.	2300/4000 Y—2300
2—	250 KVA West.	2300—460
3—	150 KVA West.	2400—230/115
1—	100 KVA G.E.	2300—575, 3 ph.
6—	50 KVA West.	2400—114 228 DRY TYPE

PARTIAL LIST ONLY

BREW, WOLTMAN & CO., INC.

50 Church St. New York 7, N. Y.

LAND'S 44th YEAR

MOTORS & GENERATORS, etc.

1 YEAR GUARANTEE

GENERATORS—250 V. D.C. Motor Driven

KW	Make	Type	Speed
1000	Al. Ch.		720
250	Cr. Wh.	CCD	1200
200	West (2)	SK-18	1200
150	West.	SK	900
125	G. E. (2)	MPC	1200
125	El. Dy.	20L	1750
100	Delco (4)		1150
75	Cr. Wh.	51H	1150
50	Cr. Wh.	HH	1150
40	West.	SK	1750
35	G. E.	RC	1750
35	Al. Ch. (4)	3 wire	1750
25	G. E.	C8	1200
15	Star		1750
7½	West.	SK-43	1750
5	West.	SK-284	1750
5	Rel.	T-23T	1750
3	Rel.	T-14T	1740

GENERATORS—Low Voltage D.C.

Amp.	Make	Voltage
10,000	H-V-W	6
10,000	J-L	18
6000	El. Prod.	18/36
5000	H-V-W	6/12
4000	North.	7½
3000	Chandey.	12
2500	Chandey.	6/12
1500	H. V. W.	6/12
750	H-V-W-	6/12
1000	G. E.	15
1000	G. E	25
1000	West	24
100	Diehl	32
200	West.	35
200	Burke	35
125	Diehl	40
500	G. E.	32
1500	Century	45
3200	G. E.	50
325	West.	50
1000	G. E.	75

230 V. D.C. MOTORS

H.P.	Make	Type	Speed
250/200	Rel.	2600T	400/800
150	West.	SK	1150
150	West.	Sk	850
125	Rel.	T	600
125/50	E. D.	20-SL	1750, 1315
100	West. (4)	SK	1150
100	West. (6)	Sk	850
100	Rel.	651-T	850
100	G. E.	RC	600
100	Rel.	1060T	500
100	A-C		1150
100	FM	TRC-38	725
110/55	G. E	DMC	800/400
90/45	G. E. (2)	RF-17	950/475
75	G. E.	CD-155	1150
75	West. (6)	SK	1150
75	G. E.	RC	1000
75	Rel.	461-T	850
75	West. (2)	SK	850
75	West.	SK	475
75	Cr. Wh.	CMC-125H	375/950
60	West.	SK	850
60	West.	SK-160	680
60	West.	SK	250/1000
50	Cr. Wh.	CMC-FH	1750
50	G. E.	CD-93	3600
50	West.	SK-160	565
50	G. E.	RF-17	250/1000
40	G. E. (3)	CD-105	850
40	Cr. Wh.	FH	1750
40	West (5)	SK	775
35	E-D	258	350/1050
35	West.	SK	250/1050
35	West	SK	1150

SLIPRING MOTORS

H.P.	Make	Type	Speed
600	Cr. Wh.	181-AQ	507
500	G. E. (2)	IM	450
200	G. E.	MT-559Y	1175
150	G. E.	IM	870
125	West.	CW	1750
125	G. E.	IM	580
100	G. E.	MT347	1150
100	G. E.	IM	690

SQUIRREL CAGE MOTORS

H.P.	Make	Type	Speed
250	GE(TENV)	K-6335	1750
200	Wagner	RP2-26Z	1800
200	West.		1750
200	A. Ch.	AR	865
200	G. E.	KF-6335	880
150	West.	CB	1175
150	G. E.	IK	580
125	A. Ch. (2)	BBR	3500
125	A. Ch. (5)	AR	1800
125	Century		3500
125	A. Ch.		690
100	West.	CS6078	3540
100	West.	CS	870

Partial Listing Only!

Please Send Us Your Inquiries

L. J. LAND, INC.

Established 1910

156 GRAND STREET, NEW YORK 13, N. Y.

CAnal 6-6976

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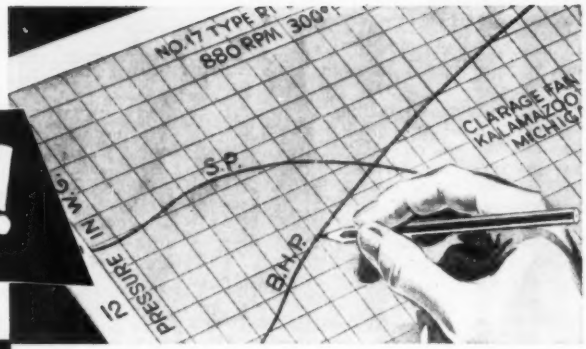

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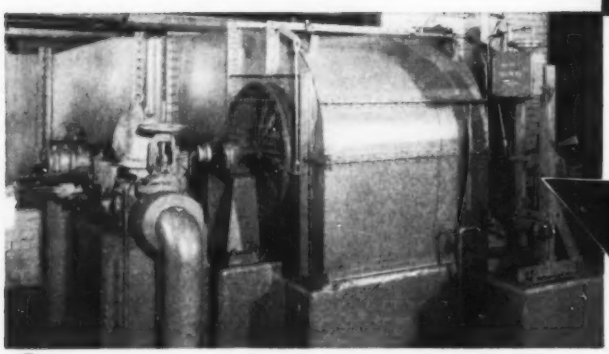

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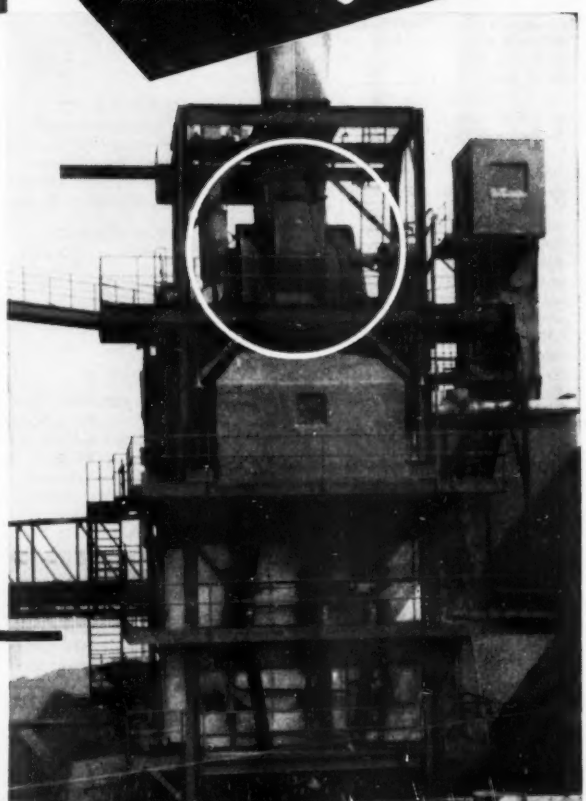

The most exacting service a fan gets into is mechanical draft.

If the fan is too small, you may lack capacity for peak loads . . . too large, and you may have wasted money and space . . . inferior construction, and, well, that's real trouble.

We are specialists with long experience in meeting mechanical draft problems.

You can have faith in a Clarage recommendation — faith that your job is figured RIGHT for the required performance — faith that the equipment is built RIGHT to operate year after year with minimum attention and care.

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The New GRINNELL MODEL R CONSTANT SUPPORT HANGER

FEATURES OF GRINNELL MODEL R CONSTANT SUPPORT HANGER:

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- Non-resonant
- Anti-friction needle bearings keep friction to a minimum
- Individually calibrated before shipment to support exact load specified
- Requires less head room
- Can be bolted directly to the building structure or suspended by either single or double rods

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Mathematically perfect constant support for all positions of travel of high temperature process and steam piping

With the new Grinnell Model R Constant Support, the pipe, its covering and contents, are supplied mathematically perfect support in all positions of travel. In addition, constant support is maintained throughout the full range of field adjustability.

The design of the new Model R provides favorably small ratios between spring force and the supported load, ranging from 1.15 to 1 minimum and 4 to 1 maximum, thereby minimizing bearing stress and prolonging the life of the hanger. This permits hangers which are smaller in size for the loads carried.

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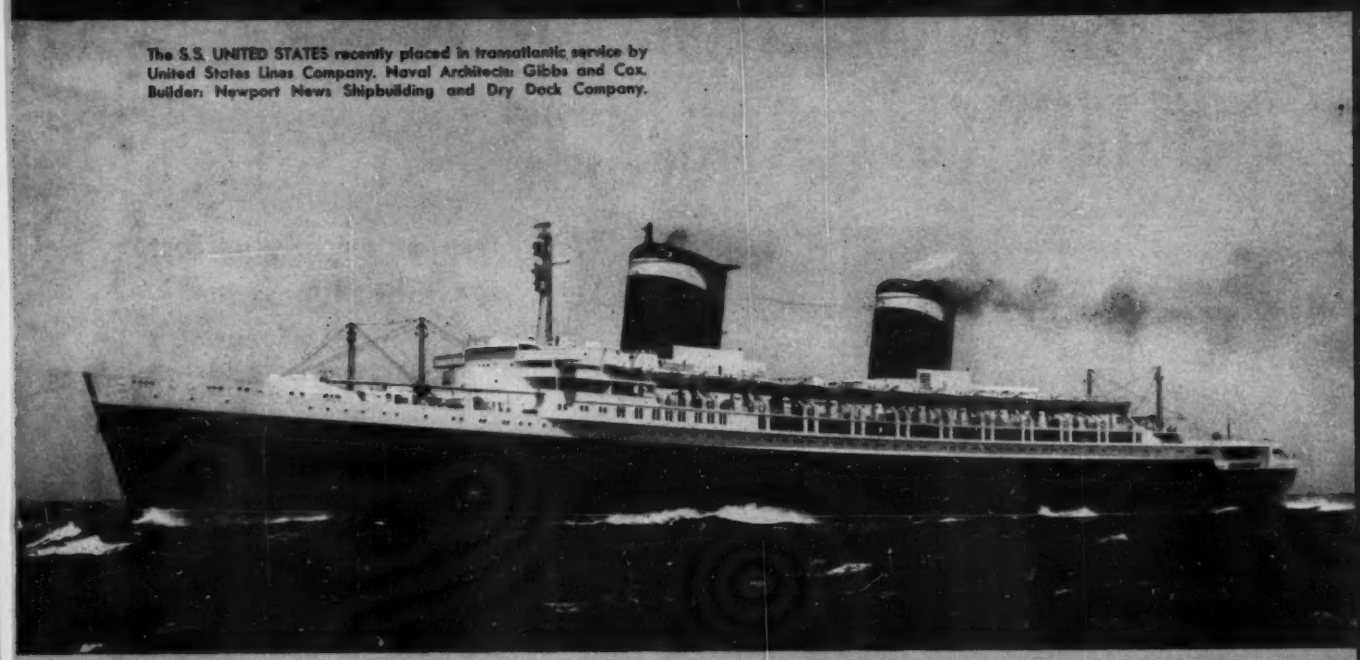

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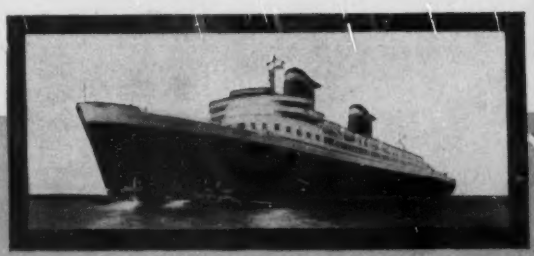

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